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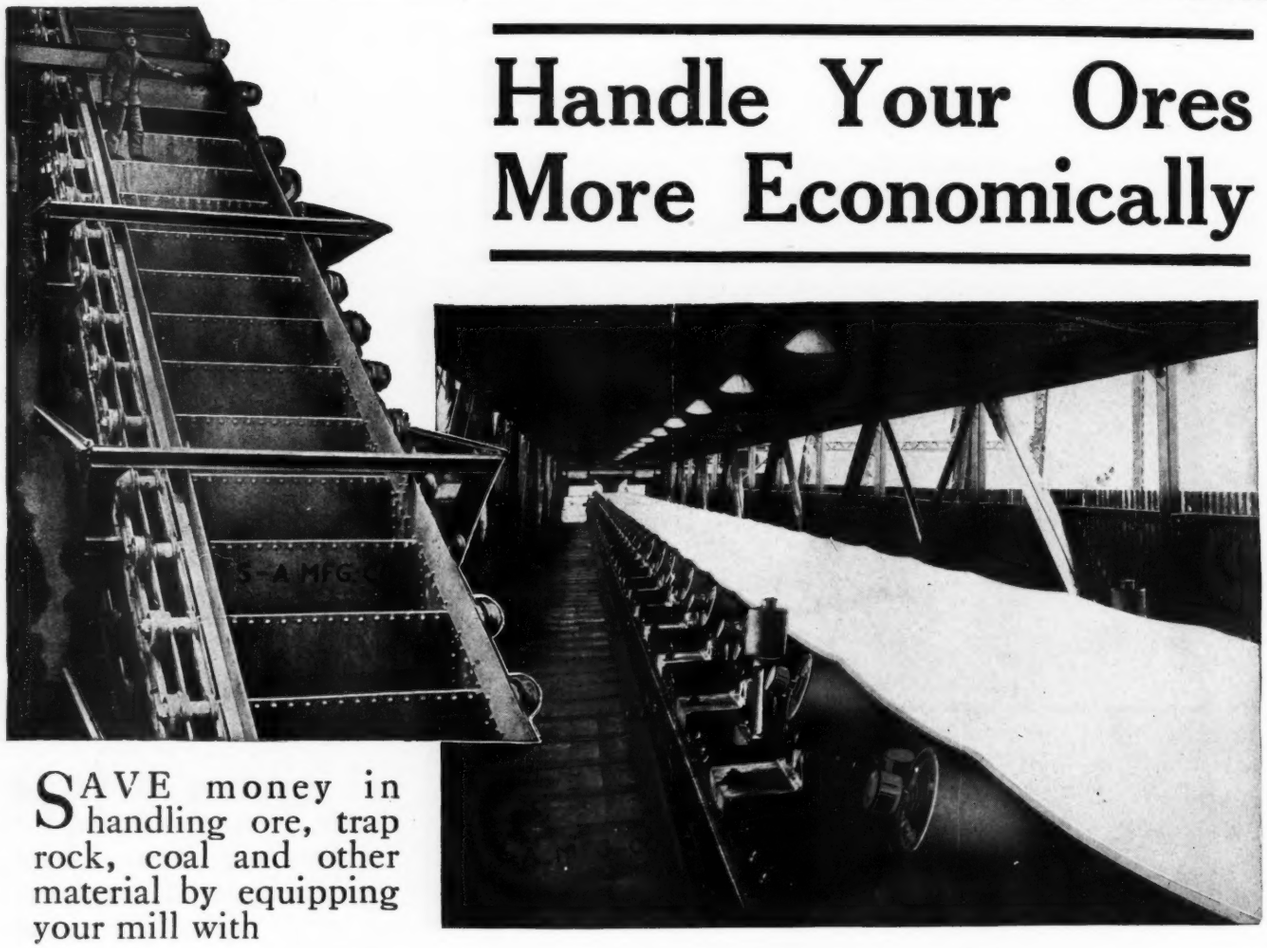

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Mining Journal

VOLUME 101 JANUARY 15, 1916 NUMBER 3

Carrie Jane Billings Everson

Until recently, little definite information was available concerning Mrs. Carrie Jane Billings Everson, whose United States patent taken out in 1886 practically embodied the underlying principles of the present process of concentrating ores by flotation of the sulphide minerals. Reference has frequently been made in the *Journal* to the pioneer work of Carrie Everson, and much effort was made both by the *Journal* and other organizations to pierce the veil of mystery surrounding the patentee of this far-reaching metallurgical discovery, which remained in obscurity for 20 or 30 years owing to lack of a successful practical application of the principles enunciated in Mrs. Everson's patent.

CARRIE JANE BILLINGS EVERSON

The portrait at the left was taken in Chicago shortly after her marriage to Dr. W. K. Everson in 1864. The other portrait was taken much later in life presumably during her residence in Colorado

With the increasing interest in flotation in the United States, further effort was made not only by the technical journals, but also by various scientific societies. It seems typical of the quiet modesty of Mrs. Everson that she failed to make herself known during the excitement of the flotation-patent litigation when she had become almost an international figure in the metallurgical world. At the very time search was being made to find her, she was living, though most searchers had concluded that she had probably died long ago. Notwithstanding that the searchers were unable to interrogate Mrs. Everson prior to her death and thus clear up many points regarding her patent, much new information has been obtained and some misconceptions removed.

To the Colorado Scientific Society belongs the credit of finding out most of the facts relative to the Eversons. It discovered among other things that Mrs. Everson had only recently died, that she did not obtain her flotation ideas from washing sample sacks in the office of her assayer-brother, that she had never been a spinster schoolteacher, that she was married in Chicago to Dr. W. K. Everson prior to the flotation discovery, and that their son is living in California. As the first practical trial of the Everson process was made in Colorado, where the Eversons lived for a number of years, the Colorado Scientific Society contemplates honoring this discovery as soon as it is possible to determine whether the honor should be bestowed upon the Eversons jointly, upon Doctor Everson or upon Mrs. Everson, who applied for the first patent on Aug. 20, 1885. John L. Everson, their son, says that his mother was solely responsible for the development of the flotation method, but a Denver acquaintance of the family during their residence in that city says he frequently heard "Doctor Everson tell about his discovery for the treatment of ores by oil, and that Mrs. Everson

always gave credit for the germ of the idea to her husband."

The *Journal's* California correspondent, Lewis H. Eddy, was at one time private secretary to "Brick" Pomeroy, with whom the Eversons were associated in some of their mining ventures. Mr. Eddy recently interviewed John L. Everson at the latter's home, in the San Anselmo hills in Marine County about 15 miles from San Francisco, and reports the following as the result of his visit:

Carrie Jane Billings Everson, generally regarded in America as the inventor of the flotation process, was about 44 years old at the time her patent was issued, Aug. 24, 1886, having been born at Sharon, Mass., in 1842. She was graduated from high and normal school. She did not begin teaching school on graduating, as is generally supposed. She was married to Dr. W. K. Everson in Chicago in 1864. Doctor Everson was an old-school physician, druggist and chemist. Mrs. Everson first took up the study of medicine, with her husband as tutor, and subsequently specialized in chemistry. She never attended medical or engineering schools. She was attracted to mineralogy through Doctor Everson's investments in mining enterprises in Colorado and Mexico. Her inclination was toward whatever scientific subject that came nearest to her daily life. She was interested in medicine because her husband was a physician, and her medical knowledge was considered equal to that of Doctor Everson. She was interested in chemistry as an allied science and became a better chemist than her husband. Mineralogy attracted her because she believed that mining would become pecuniarily profitable as well as scientifically interesting.

Mrs. Everson had a brother who was an assayer, but whose practice and research had nothing to do with mineralogy or mining, so that he gave her no assistance whatever in her experiments. The assistance that she obtained from Doctor Everson was merely of a consulting nature. While he was naturally interested in mineralogy and metallurgy through his investments and his wife's research, he did not attempt the study of these subjects with a view of applying his own mind to the practical treatment of ores.

EVERSON'S MINING INVESTMENTS UNSUCCESSFUL

Doctor Everson's mining investments brought him nothing but loss and practically financial disaster. The investments were made through M. M. ("Brick") Pomeroy, widely known as an editor and promoter during a period of more than 30 years. The Eversons had formed a very warm personal friendship for Pomeroy between 1876 and 1879, while he was publishing "Pomeroy's Democrat" in Chicago. Pomeroy went to La Crosse in 1879 and moved to Denver in 1880, where through the publication of his paper (then called "The Great West") he induced the investment of many thousands of dollars in mining stocks, most of which was expended in exploitation and development, that yielded very little profit to anyone and resulted in Pomeroy's return to New York without money and with a bad reputation as a mine promoter. I was employed by Pomeroy as private secretary in Chicago, La Crosse and Denver during the period of Doctor and Mrs. Everson's personal relation with him, and I know that he did not profit permanently by the investments of the Eversons and hundreds of others that intrusted their investments to him. Because of their personal friendship for Pomeroy, Doctor and Mrs. Everson suffered keenly, not only from their monetary loss, but from the loss of confidence in the man to whom they intrusted their entire fortune, amounting to about $40,000.

Mrs. Everson probably began her study of mineralogy as early as 1878, and about 1880 began the investigations and research that resulted in her patent in 1886, while her husband was in Mexico. The Eversons removed from Chicago to Abilene, Kan., and thence to Denver. Their advent in Denver in 1888, followed shortly after the return of Pomeroy to New York. Doctor Everson died in Denver in 1889. Mrs. Everson had given up hope of any return from their investments in mining, but she believed stongly in her invention and was confident that, if given proper attention, the flotation process would be applied commercially and economically to the metallurgy of ores.

At the time of Doctor Everson's death, their son, John L., was about 17 years old. Through association and tutelage, the boy became practically interested in the process, and when in 1890 Thomas F. Criley formed a copartnership with Mrs. Everson, young Everson assisted him in a practical demonstration at West Cliff, in the neighborhood of Silver Cliff, Custer County, Colo. These experiments and demonstrations were considered satisfactory in results, but so little encouragement was offered them in Colorado that it was determined to send Criley to Baker County, Oregon. There was at that time, or had been just prior thereto, some mining excitement in the Sparta district in the Powder River region. Criley put up a demonstrating plant and experimented successfully with sulphide ores of the district and also made some demonstrations at Baker City.[1] He died either at Baker City or Portland, and Mrs. Everson went to Oregon in the hope of straightening the tangle in which the affairs were left at the time of Criley's death. But she was not a good promoter and business woman, and so nothing of practical value to herself resulted from the efforts of Criley in Oregon.

According to her son, John L. Everson, after Criley's death and subsequent failure to interest mining companies or investors in the oil-froth method, his mother made but little effort to continue the exploitation of this process and devoted her time to research and experiment with a dry process of flotation; with Charles B. Hebron, a patent was taken out about 1892. Hebron secured the financial assistance of a Mr. Pischel, also of Denver. They obtained the use of a chemical plant and laboratory in a suburb of Denver and proceeded with experiments and demonstrations of Mrs. Everson's dry process of flotation. Hebron and Pischel got into a quarrel over money matters or divisions of interests, and finally Mrs. Everson gave up hope of any financial benefit from either of her processes.

Mrs. Everson went to California in 1909 to make her home with her son at San Anselmo, where she died on Nov. 3, 1914. For two or three years just prior to going to California, she taught physiology and hygiene in the State Reformatory for girls at Morrison, Colo. From this might have been obtained the impression that the inventor of flotation process was a school teacher. Mrs. Everson had never taught school at the time her flotation experiments were made, although she graduated from a normal school and was prepared to take up teaching as a profession. Her marriage to Doctor Everson turned her mind and her talents toward medical and chemical science and thence naturally, in view of their mining investments, to mineralogy and metallurgy. That she did not receive any benefit from her discovery was due primarily and largely to the loss of her husband's accumulated earnings, but in no small degree to the fact that as a metallurgist she was a quarter of a century in advance of her profession.

DENVER RESIDENT SAYS DOCTOR EVERSON WAS THE INVENTOR OF FLOTATION

A somewhat different account has been published in the Denver press, which interviewed Everett A. Fay, a bookkeeper in the Denver National Bank. Fay, who knew the Eversons when they were living in Denver, is quoted as saying:

The Eversons came here early in the '80s for the doctor's health. He was a practicing physician from Chicago and, as we understood it, was possessed at one time of considerable financial means. His wife was a school teacher. Both were highly intellectual. Mrs. Everson was a little woman physically and very modest and retiring of disposition. She was a most lovable character and all who knew her admired her greatly.

We were acquainted with the Eversons in those days and I often heard the doctor tell about his discovery for the treatment of ores by oil. He had impressed Mrs. Everson so strongly with the value of the discovery that after his death she went ahead and took out patent papers. Her first partner was a Denver blacksmith, named Criley, who had become interested in the process and thought he could bring it to the attention of the mining world.

Mrs. Everson always gave credit for the germ of the idea to her husband, Doctor Everson, but there is no doubt that his wife helped him in the conception and later developed its application to mining, as evidenced by a subsequent patent issued about 1892. She was a woman of high education, entirely capable of having thought out the whole thing, herself.

It is conflicting evidence of this character that is being sifted by the committee of the Colorado Scientific Society and is delaying the award of a suitable testimonial. Human memory is notoriously at fault, and there is often uncertainty respecting information about long-past events that depends upon recollection unsupported by docu-

[1] "Eng. and Min. Journ.," Nov. 15, 1890.

mentary evidence. The fact that the name of Carrie Everson is the only one that appears in the patent papers is a strong ground for the presumption that she was the sole inventor.

The Classic Flotation Patent

As a matter of interest, we reprint Mrs. Everson's first flotation patent verbatim:

CARRIE J. EVERSON, OF CHICAGO, ILLINOIS

Process of Concentrating Ores

Specifications forming part of Letters Patent No. 348,157, dated August 24, 1886.

Application filed August 29, 1885. Serial No. 175,665. (Specimens.)

To all whom it may concern:

Be it known that I, Carrie J. Everson, of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful improvement in Processes of Concentrating Ores; and I do hereby declare that the following is a full, clear, and exact description thereof.

The discovery which forms the basis of my invention is that metals and metallic substances in a comminuted state will unite with compounds of fats or oils and acids, and that such compounds will not unite with comminuted quartz or other rocky gangue. The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral, or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil, or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt, for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material, whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing or other suitable means.

The invention is more specially applicable to the treatment of ores in which the metal or metallic portion is mixed with quartz or other rock as distinguished from the mixture of mineral with clay, though it is applicable to ores containing alumina, together with quartz or other rock, to the extent of permitting the removal of the silica or sand.

The operation of concentration as a whole, or in its practical form as applied to the separation of rocky mineral ores, involves the reduction of the quartz or other rock containing the mineral to a powder, the addition thereto of the fat or oil and acid or salt, and the subsequent removal of the gangue.

If my invention is inapplicable to any particular rocky ores or class or classes of rocky ores, or to the concentration of any particular metal, such limitations are not now known to me. Its commercial value, however, will probably be restricted to its use in connection with ores bearing the precious metals, such as gold, silver, and copper.

Among the ores upon which I have operated successfully by means of my invention are the following: Ores containing native gold and silver, kerargyrite, argentite, argentiferous galena, and a variety of double and otherwise compound sulphides of silver, with copper, antimony, arsenic, and other base-metal sulphides. I have also operated successfully upon pyritic ores, white, yellow, green, and intermediate shades, having variable constituents of iron, copper, arsenic, and sulphur, and mostly auriferous, and having variable proportions of such constituents. I have also operated successfully upon ores containing tellurides of gold, silver, and lead, and others containing the oxides and carbonates of copper and the carbonate of lead. All the metals or metallic mineral portions of these ores are acted upon by the admixture described, in such manner as to permit the rocky gangue to be removed by a washing process, after which several metals may be separated by the usual means.

In putting my invention into practice any fat or oil, and any acid, either mineral or vegetable, or any soluble neutral or acid salt, or any compound of fats and oils with appropriate acids, may probably be successfully employed, at least such is the case with all of these agents with which I have so far experimented. I have used petroleum and one of its several constituents—namely, paraffin oils—also tallow, (melted,) lard- lard-oil, red-oil, (impure oleic acid,) cotton-seed oil, castor-oil, sperm-oil, and linseed-oil, and some combinations of these with each other. The acids which I have employed are sulphuric, hydrochloric, nitric, phosphoric, acetic, oxalic, tannic, and gallic. I have also used the following salts, to wit: the sulphates and chlorides of sodium, zinc, and copper, and the double sulphate of potash and alumina. The selection of the appropriate agents will, however, be largely determined in the practical working of my invention by the consideration of economy, which will obviously exclude the greater number of those above enumerated. A reasonably cheap and practicable use of my invention will be as follows, the quantity named being suitable for laboratory use and the character of the ore specified being substantially that of an ore upon which I have successfully operated by the preparation and in the manner hereinafter described.

Take an ore assaying twelve ounces per ton in silver and containing forty-eight per cent. silica, 6.3 per cent. zinc, 1.5 per cent. copper, fifteen per cent. iron and aluminium, 6.5 per cent. lead, 14.18 per cent. sulphur, 7.19 per cent. arsenic. Of this ore take four (4) ounces by weight in pulverulent form, prepare a mixture containing sulphuric acid, cotton-seed oil, and water, in all about twelve fluid drams, of which ten drams are of water and about two drams are acid and oil in the proportions of fifteen parts of the oil and two parts of the acid by measure. In making this fluid mixture the acid and oil are first mixed with each other, the acid being added to the oil very gradually, so that the temperature will not rise above 120° Fahrenheit. The stirring in of the acid should be thorough, as it tends at first to gravitate to the bottom. After a few hours, in a summer temperature, the mixture will be ready for use, and, preferably, in such a temperature should not be prepared long before using, though if it should have stood long enough to solidify it should be gently heated before adding the water thereto. In winter or in air-tight vessels it may be kept for a number of weeks or even longer, and then rendered fit for mixing with water by heating gently when required for use. The water may be advantageously added in installments of about three equal parts, and the mixture stirred after each addition of water until it stiffens. After stirring in the entire quantity of water the compound is added to the ore, the proportions of ore and compound being chosen with a view to producing a stiff mass after the materials have been incorporated, such proportions being therefore variable in different cases with this end in view. The stirring or incorporation of the ore with the liquid should of course be thorough for the purpose of bringing the mineral into contact with the oil and acid as completely as possible, and after such incorporation the mass is then in condition for the washing out of the quartz by the action of water which will be applied to the mass in sufficient quantities for this purpose. The washing should promptly follow the mixing, and in this operation the mass be opened out or broken up and thoroughly stirred in the water, in order that the sand or quartz may be freed and carried away. In treating so small a bulk as above specified the mass may be squeezed repeatedly in the hand in a basin of water, the substance so manipulated being expressed between the fingers each time it is squeezed, and thus made to expose new surfaces to the water from which the sand will be detached, so as to fall to the bottom of the basin. In practice upon large masses any vessel having an outlet or outlets at its bottom for the escape of the water and sand will be suitable for this operation of washing, and mechanical means will of course be employed to break up the mass. The concentrated mineral will accumulate in a pasty mass or lump or lumps and will contain the metallic portion of the ore, together with the hydrated oil and acid, which latter may be removed by heating and afterward roasting, or by other suitable means. The use of petroleum or of a constituent thereof, either by itself or in combination with tallow, (heated,) cotton-seed oil, or other fat or oil, will be even less expensive.

When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituent, paraffine-oil, one or two fluid drams of acid to one gallon or water is sufficient for this purpose. The petroleum which I have used was 30° Baumé, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore.

In the use of petroleum, or of a liquid constituent thereof, like paraffine-oil, the condition of the concentrated mass is more liquid than when a vegetable or an animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will

be floated off. Devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores. After removing the quartz or rock by washing or any suitable means the mineral may be roasted, in which operation the water, if present, will be dispelled, the oil will burn out, and the acid will be decomposed and eliminated, in the case of sulphuric-acid, which will commonly be used, by conversion into sulphurous-acid gas, which passes off. In case fixed oils are used the mass may be allowed to stand until the water has run off. To hasten the operation of removing the water the mass may be heated, say, to about 212° Fahrenheit or less, whereupon the water will generally be promptly freed and may be poured off or it may be evaporated. The operation of smelting is facilitated by the presence of the fat acting simply as a fuel.

The disposition made of the mineral or metal after concentration, whether by roasting and subsequent smelting or by smelting without previous roasting, or otherwise, belongs to the after treatment and is not material to my present invention. The proportions in which the acids or salts are added to the oils or fats may vary according to the kind of acid or oil employed, and also according to the kind of ore to be treated; and the manipulation of the substances employed may be varied from that above set forth in either formula given. These matters may be determined in individual cases by the operator; and I do not, therefore, restrict myself to any particular proportions of the substances employed, though I have above indicated proportions of certain acids and oils by one of the other of which practical results may be obtained upon almost all varieties of ores.

It is also not essential to my invention that the acid or salt employed with a vegetable oil be added to the oil before the incorporation of the oil with the ore, as it is entirely practicable, at least in most, and possibly in all, cases, to first mix such oil with the ore and thereafter add the acid, as set forth in the use of petroleum.

I am aware that it has been proposed in a patent to Tunbridge, No. 228,004, dated May 25, 1880, to recover finely comminuted metal held in suspension in water by the use of soap or a saponaceous compound formed by a partial or imperfect blending of an alkali or an alkaline salt with a fat or an oil. The action of the soap or saponaceous compound when diffused through hard water containing the metal in suspension is to form with the lime salt in the water a coagulum in which the particles of metal are enveloped and by which they are held during a subsequent removal of the water. When the water is soft a lime salt must be added to form the coagulum. I disclaim the use of any substance in connection with the fats and oils capable of saponifying them. I also disclaim the method set forth in said Tunbridge patent as being entirely dissimilar to that herein claimed. Said Tunbridge method is stated in said patent to consist "in first depriving the water of as much earthy non-metallic matter as possible," this being effected by any of the ordinary methods in use for that purpose, such as letting it stand until the earthy matter precipitates. My invention, on the other hand, has reference solely to the separation of metal or metallic mineral from earthy non-metallic matter, (rocky gangue,) and not to its subsequent separation from water. In the practice of my method, moreover, the metal or mineral and non-metallic matter (rocky gangue) are together and in the first instance mixed with the fat or oil, and the non-metallic matter is afterward separated from the metal or mineral by the peculiar action of the acid or soluble neutral or acid salt operating in the presence of water to detach the gangue from the mass.

With the understanding that I am not restricted in the matters mentioned, I claim broadly—

1. In the separation of pulverulent ores containing rocky gangue, the method of treatment herein described, which consists in mixing with such pulverulent ore a fat or an oil or a constituent thereof, an acid or soluble neutral or acid salt, and water, finally breaking up the mass to allow the sand to separate therefrom.

2. The method, substantially as described, of separating metals or metallic minerals from rocky gangues, which consists in mixing a fat or an oil or a constituent thereof with pulverized ore and washing out the gangue with water containing an acid or a soluble neutral or acid salt.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

CARRIE J. EVERSON.

Witnesses:
M. E. Dayton,
G. F. Lanaghen.

Restrictions on the Diamond Trade

It might be supposed that the trade in diamonds as a pure luxury would be practically stopped by the war. The British government, however, according to the London *Mining Journal,* has found it necessary to make certain ordinances to prevent the Germans from sending over some of their remaining stock of Southwest African stones, cut in Antwerp by what may have been forced labor, and exchanging them for British gold. On the other hand, Germany has since tried to secure rough diamonds and carbon for the use of her munition and other factories.

With regard to polished diamonds coming over, a check has been instituted by the Home Office, which in every case requires a certificate of origin showing that such stones as are allowed to pass have been cut in Holland from rough, other than Southwest African. This certificate is obtained from a technical commission and has to be legalized at the British consulate.

Any consignments of diamonds not accompanied by such certificates are held up by the Post Office under the Home Office, and returned in doubtful cases, while diamonds brought into England by travelers are liable to confiscation. No such certificate of origin is needed for importation from British Colonies and allied countries.

On the other hand, to prevent rough diamonds reaching Germany, the exportation is either prohibited or controlled by a commission nominated by the government. The members of this commission are Alfred Mosely, L. Breitmeyer and V. A. Litkie, all connected with Kimberley mining since the early seventies. This commission examines every single parcel of any consignment, and the Post Office will not accept any registered letters or parcels unless the same bear the seal of the commission.

For stones sent out to be polished, 25% of the value has to be deposited and will be returned only on proof having been given that they have been so treated. This is done with a view to prevent Germany from obtaining rough diamonds. The regulations are so far-reaching that crushing bort (the common diamond used for polishing) may be exported in powdered state only, and in order to have a better control of ultimate use, the commission has delegated to Messrs. Triefus exclusively the function of supplying it to the factories.

It may be of interest to state that during the first few months of the war the outlook for the diamond trade was very black, but its stability has been secured and maintained since, owing to the timely measures of the big South African mines and the London Syndicate.

Jones Mixer Case Decided—The Jones mixer case, which has been so long in the courts, has at last approached what looks like a final settlement. The United States Supreme Court, by its refusal to grant a writ of certiorari Nov. 8, decided finally that the Cambria Iron Co. must pay the Carnegie Steel Co. $568,305, with interest from May 1, 1912, for the infringement of the Jones mixer patent used in making steel. This amount was allowed by the Third United States Circuit Court of Appeals. It was complained by the Carnegie company that the defendant company had infringed on the Jones patent from Nov. 1, 1895, to Oct. 31, 1898. During this period the defendant company passed 520,188 tons of molten blast-furnace metal through the mixer and remelted in cupolas about the same quantity of blast-furnace iron. The Carnegie company averred that there was a saving of over $1 per ton by the Cambria company through the use of the Jones patent.

Mining in Japan in 1915

By H. W. Paul*

According to the Imperial Japanese Mining Bureau, the total value of the mineral and metal production of Japan, Chosen and Formosa during the last few years was as follows: 1911, 105,929,517; 1912, 130,241,335; 1913, 145,848,792; 1914, 153,309,716 yen.[1]

In these figures the production of the Imperial Steel Works, which amounts to about 13 million yen per year, is not included. Owing to a setback in the coal output, the value for 1915 will probably not show an increase at the same rate as in the preceding years. Roughly estimated, the value may, however, reach 160,000,000 yen.

In Table 1 is a list of the production of the principal minerals and metals during 1914 and of the estimated output for 1915.

TABLE 1. CLASSIFIED PRODUCTION OF MINERALS IN JAPAN FOR 1914 AND 1915

	1914		1915	
		Yen	Jan.-Sept. Compared With Jan.-Sept., 1914	Total Year Estimated, About
	Metric Tons			Metric Tons
Coal	21,315,962	70,956,121	8.8% Dec.	19,000,000
Copper	69,816	38,350,311	7.7% Inc.	75,000
	Liters			Liters
Petroleum	424,456,920	9,631,049	17.5% Inc.	500,000,000
	Kilograms			Kilograms
Gold	7,217	9,430,722	24.0% Inc.	8,900
Silver	151,447	5,384,275	2.0% Inc.	155,000
	Metric Tons			Metric Tons
Iron and steel. Steel of the Imperial Steel Works	89,630	3,563,136	19.0% Dec.	73,000
	230,928	13,383,611	Increase	250,000
Sulphur	74,115	2,002,788	5.0% Dec.	70,000
Spelter	5,880	1,359,961	Increase	8,000 to 9,000

It will be seen from this table that the mining industry of Japan has in general been favored, but not at all in a proportion commensurate with the large demand for metals created by the war.

The output of coal, which makes in normal times about one-half of the total value of the Japanese mining production, has been greatly decreased. This was caused mainly by a lowered demand for fuel owing to the decrease of ships calling on eastern Asiatic ports since the war started. The export of coal during the first 9 months of 1915 was about 2,000,000 tons, which is 1,000,000 tons less than for the same period of the preceding year. There are about 51 principal coal mines, the main districts being Hokkaido and Kyushu. Table 2 gives a list of the mines with a production of more than 500,000 tons each per year.

TABLE 2. THE PRINCIPAL COAL MINES OF JAPAN

	Tons per Year, About
Yubari mine (Hokkaido Coal and Steamship Co.)	700,000
Iriyama mine (Iriyama Coal Mining Co.)	530,000
Miike mine (Mitsui Mining Co.)	2,000,000
Mitsui-Tagawa mine (Mitsui Mining Co.)	983,000
Onoura mine (Kajima Mining Co.)	790,000
Futase mine (Department of Agriculture and Commerce)	600,000
Yoshinotani mine (Mitsubishi & Co.)	540,000

The increased output of petroleum is mainly due to the increased production of the Kurokawa oil field of the Nippon Petroleum Co., which could have increased its production of about 108 million liters in 1914 by at least 35% in 1915. All the principal oil fields are situated in the Niigata district in northern Japan. The demand for light oil is decreasing in Japan, owing to the increased use of electric and gas lights, but the demand for crude oil for the navy and the railways is steadily increasing.

The great demand for copper as war material naturally favored the Japanese copper industry largely. Copper has been largely exported to Russia and England, the total reaching about 38 million yen during the first 10 months of 1915, which is nearly double the value of copper exported during the same period of 1914. There are about 41 large copper mines in Japan, but more than one-half of the total amount of copper is produced by the four principal mines and smelters, as shown in Table 3.

TABLE 3. THE PRINCIPAL COPPER MINES OF JAPAN

	1914 Production, Metric Tons	Jan.-June, 1915, Compared With Jan.-June, 1914 Increase	Total 1915, Estimated, Metric Tons
Hitachi mine and smeltery (Kuhara Mining Co.)	10,132	17%	12,000
Ashio mine and smeltery (Furukawa Mining Co.)	10,632	3%	11,000
Kosaka mine and smeltery (Fujita & Co.)	7,520	4¾%	8,000
Besshi mine and smeltery (Sumitomo Mining Co.)	7,446	1%	7,500

These plants are treating not only the ores of the mines they are attached to, but also copper, silver and gold ores bought from other mines.

The production of gold and silver increased on account of the increased refining of argentiferous and auriferous copper in electrolytic refineries, gold and silver ores being treated together with copper ores and the resulting black copper refined to electrolytic copper, which is especially demanded as war material. The production of silver increased only slightly as compared with gold, owing to the partial closing down of the Tsubaki silver mine because of financial difficulties. This mine once belonged to the largest silver producer in Japan.

There are about 28 gold mines and 21 silver mines, but most of them have a comparatively small production.

TABLE 4. PRINCIPAL JAPANESE GOLD AND SILVER PRODUCERS

	Production, 1914 Kilograms	Estimated Production, 1915 Kilograms
Hitachi copper smeltery and electric refinery (Kuhara Mining Co.)	2,717 gold 25,084 silver	3,000 gold 37,000 silver
Sado gold mine (Mitsubishi & Co.)	552 gold 4,250 silver	600 gold 4,250 silver
Kosaka copper smeltery and electric refinery (Fujita & Co.)	338 gold 30,000 silver	350 gold 30,000 silver
Yamagano gold mine (Prince Shimazu)	423 gold	450 gold
Matsuoka mine (Fujita & Co.)	100 gold	500 gold

The largest ones are shown in Table 4. The gold production of Chosen is of course not included in the table. Its value is about 10 million yen. The total value of the mineral output of Chosen is about 13 million yen.

Although the trade in steel has doubtless been greatly favored by the war, a depression prevails in pig iron for making utensils for home use. Japan has only a few iron mines, and they are not of importance. The existing demand in Japan for iron and steel is stated as being about one million tons per year; about one-third of this amount can be provided by steel and iron works in Japan, and this only by importing about 300,000 tons of iron ores from China. The Imperial Steel Works is producing about 250,000 tons of steel a year, and great efforts are being made to increase its capacity, but as the country

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[1]The yen is almost equivalent to 50c.

has no iron orebodies of any importance, her iron and steel works will always be dependent on the importation of ores. That evidently constitutes a great drawback to the iron industry which, being the foundation of many other industries, results in a drag upon the development of industry in general.

Although the demand for sulphur in the United States and Australia remains unaffected by the war, the scarcity of bottoms has hampered the export and consequently the production has been curtailed. The zinc-refining industry of Japan is of recent origin and not yet important, but is interesting, considering the efforts made in other countries at present to create new zinc smelteries. Zinc mining has been practiced in Japan for only about 10 years, the ores being exported to Europe. The zinc-ore export amounted to about 30,000 tons in 1912, but fell off in the following years as zinc refining increased in Japan. Zinc metal was mentioned for the first time in the official statistics of 1913, the production of that year being given at 900 tons. Apparently not much profit was derived from zinc refining in Japan until the war brought about those abnormal spelter quotations. Besides some experimental enterprises started recently because of the high zinc prices, there are two companies producing a fairly large amount of the metal now—the Mitsui Mining Co., in the Miike smeltery, and the Osaka Zinc Refining Co. It is difficult to obtain information about the exact production of those two plants, as everything about the zinc-refining business is kept secret. The output of the Mitsui smeltery is at present certainly not larger than 450 tons a month, while that of the Osaka Zinc Refining Co. is somewhat lower as well as irregular. According to its business reports, the Osaka Zinc Refining Co., founded in 1912, operated at a loss until September, 1914. For the following six months there was an operating profit of 75,000 yen, and for the period April-September, 1915, an operating profit of 338,000 yen. Taking now into consideration the extremely high spelter prices and the fact that the prices for zinc minerals did not advance in Japan in proportion to the price for the metal, the first cost incurred by that company in producing zinc metal must have been very high; certainly much higher than a normal spelter price would allow. Evidently, also, the Japanese metallurgists will find that the metallurgy of zinc is the most difficult of all, and long experience for engineers and workmen is necessary before a new smeltery will run satisfactorily and assure a regular production of metal of reliable quality, at economical costs.

TABLE 5. OTHER MINERALS AND METALS

	Metric Tons	Yen
Lead metal	4,562	827,282
Tin metal	97	304,873
Tin ores	289	.....
Iron pyrites	115,876	600,605
Antimony	25	2,788
Manganese ore	16,875	159,373
Tungsten ore	195	187,712
Phosphate	38,250	508,182
All others	.....	115,966

Table 5 gives the production of other minerals and metals in 1914. The output of most of these has probably increased somewhat in 1915, but no increase of any importance has so far been reported.

Mining at Juneau in 1915

JUNEAU CORRESPONDENCE

The Juneau gold belt comprises, in the main, a strip running from Windham Bay northwest to Lynn Canal at Berner's Bay, all in southeastern Alaska. It may be divided into the immediate Juneau belt and the vicinity of Juneau.

The Juneau district received greater impetus in 1915 than in any previous year of its history. This was due to the arrival at the productive stage of the Perseverance mine, under the management of the Alaska Gold Mines Co., and the big development work on the Alaska Juneau properties, which will be described in detail in this article.

The attention of capital has been brought to this field through the operations of the companies named and through other natural causes, such as the war in Europe and the start of the government railroad from Seward to Fairbanks, with its prospect of tapping the Broad Pass and Matanuska fields.

Mining is engaged in during the entire year in the Juneau gold belt, made possible by favorable climatic conditions and good transportation. The orebodies are large. The character of the ores and the topography of the country make for cheap low-grade mining. Much valuable water power makes the production of power cheap in this district.

The Alaska Gold Mines operations, with excellent mining methods and milling facilities, prove that ore running less than $1 per ton can be mined at a profit on a large-tonnage basis. As an example, during the month of September, 1915, the Perseverance mine, in conjunction with its mill at Thane, showed a total cost of mining and milling of 60c. per ton, 15c. under the original estimate of the engineers in charge of the plans for the company.

In taking up the Juneau fields, it will be clearer to the reader to subdivide the operations into producing mines, mines under development, and prospects and properties under competent investigation.

The Treadwell group of mines consists of the Treadwell, the 700-Ft., the Mexican and the Ready Bullion mines, situated on the east side of Douglas Island, directly across Gastineau Channel from the City of Juneau, all along the strike of a single lead.

The Treadwell company hardly needs introduction to those interested in mining, having been in the producing class since 1882. The company's first productive year of any magnitude was 1885, when the yield was $280,479. This has steadily increased until in 1911 it reached its largest production, $4,983,474.

Briefly, the deposits of the Treadwell consists of mineralized dikes of albite diorite intruded into black slates and belonging to a series of instrusive bodies that appear at intervals along a zone approximately 3,000 ft. wide and 3 mi. long.[1] The mineralized dikes are cut by veinlets of quartz and calcite, and the commercial values

[1]Spencer, A. C., "The Juneau Gold Belt, Alaska"; U. S. Geol. Survey Bull. 287, pp. 95-97, 1906.

of the deposits lie in the dissemination of mineralization that makes great bodies of material available as ore. The average yield per ton of ore milled under the Treadwell system, which employs 1,000 stamps in crushing, was between $2.30 and $2.40 per ton, and operating costs between $1.15 and $1.30 per ton.

Development during 1915 consisted in opening up the lower levels in the Treadwell mine, which brought the mine down to the 2,300-ft. level, more sinking in the Ready Bullion and the usual yearly development. It

VALUE OF GOLD PRODUCTION OF TREADWELL GROUP OF MINES, DOUGLAS ISLAND, ALASKA.

1882-1884..	$10,902	1895.....	$852,585	1906.....	$3,805,324
1885.....	280,479	1896.....	1,028,691	1907.....	2,520,000
1886.....	366,180	1897.....	1,011,693	1908.....	3,124,047
1887.....	476,934	1898.....	1,010,235	1909.....	3,534,871
1888.....	429,889	1899.....	1,611,857	1910.....	3,737,498
1889.....	652,490	1900.....	2,081,840	1911.....	4,983,474
1890.....	160,681	1901.....	1,665,373	1912.....	4,080,300
1891.....	769,765	1902.....	2,223,373	1913.....	3,904,066
1892.....	707,017	1903.....	2,667,914	1914.....	3,743,945
1893.....	694,658	1904.....	2,845,994	1915 (Est).	3,250,000
1894.....	909,990	1905.....	3,146,715		
				Total....	61,568,780

may be of general interest to state that the Treadwell group has produced to date over $60,000,000 in gold, being more than eight times the price paid Russia by the United States for the entire Territory of Alaska.

The year saw the Perseverance mine, of the Alaska-Gastineau Mining Co., brought into the producing stage with one of the best developed mines and one of the most complete mills in the world. The notable feature of the Thane mill is the entire absence of stamps, all crushing being done dry with rolls in two main stages, coarse crushing and fine crushing.

In addition to the 8,000-hp. hydro-electric plant at Salmon Creek, the Alaska-Gastineau Mining Co. finished the Annex Creek power project—that is, the first unit of this project—late in December. The first unit will develop 4,000 hp., and it is planned to double this power with the second unit, to be installed later. The power from Annex Creek is to be brought over the mountains 15 mi. Steel transmission towers are used on the line.

The Perseverance mine is about 4 mi. from Juneau, in Silver Bow Basin. The lodes are of the band slate type, characteristic of the Silver Bow locality, dipping northeast, containing many diorite dike intrusions, and where in general the principal lodes of the stringer type are near the foot wall of the slates. They are bordered on the west by greenstones and on the east by schists.

The ore is brought by trolley through a 10,000-ft. adit to the mill at Thane, 4 mi. from Juneau, on the shore of Gastineau Channel. The mill has a daily capacity of 6,000 tons, and it is planned ultimately to double this with another unit which, in itself, will be divided into four sub-units of 1,500 tons' capacity, like the original mill. An average of 750 men was used in the mine and mill during 1915.

Mines Under Development in the Juneau Belt

The Alaska Juneau mine, while a small producer, is still in development. This mine, situated close to the Perseverance and evidently in the same character of ore, saw developments pushed in drifting and opening up stopes during the year. The pilot mill ran to full capacity throughout the year, and late in October excavation started for the 8,000-ton mill to be completed when the mine has reached the productive stage.

The millsite is on Gastineau Channel, practically in the City of Juneau, and the ore is brought through the 6,500-ft. adit and over a tramway approximately 10,000 ft. long. Power for the Alaska Juneau is derived from the Treadwell plant, and future plans provide for a large steam-power plant on the Juneau side of the channel, using oil as fuel. An average of 200 men was employed in the mine and mill during the year.

The United States Smelting, Refining and Mining Co. continued development of the Ebner mine. Unfortunately, much litigation as to the ownership of this property leaves it still in the early development stage and a doubtful factor in the Juneau field for the present, at least. Drifting and raising continued throughout the year. The average number of men employed during the year 1915 was below 50.

A notable new development in the Juneau field during 1915 was the start of development work on the Nelson-Lott claims (Alaska Gold Belt Co.) which adjoin the Alaska-Gastineau holdings in Sheep Creek basin. By the end of December, 1915, 2,500 ft. of tunnel had been driven to tap the orebodies, a millsite on the shore of Gastineau Channel cleared and preparations made for a small water-power installation. The character of the supposed ore-bearing zones of the Gold Belt claims is similar to that encountered in the Perseverance and Alaska Juneau properties.

The Alaska Treasure Consolidated mines, a Nevada Creek property, situated about a mile from Gastineau Channel and 4 mi. southwest from Treadwell, again started development late in 1915, the property having been sold and relieved of previous financial embarassment.

The formation at Nevada Creek is a schistose greenstone, greatly altered and showing a mineralization covering an area one mile wide and a mile and a half long. The commercial area is a zone averaging approximately 90 ft. in width and traceable for 2,000 ft. on the surface. Previous development consisted in about 4,000 ft. of drifting, of which 3,000 ft. is an adit tunnel. Late in 1915 there were 50 men at work developing this property.

Hallum, Salmon Creek and Boston Group properties were developed only slightly during 1915, owing to legal entanglements. Some advance was made in the Hallum tunnel on Mount Juneau, and surface prospecting was done, but litigation stopped all this work late in the fall.

During 1915 preliminary plans were laid for the future development of the Taku-Alaska claims by local men, and the Harrington claims were thoroughly investigated by engineers representing New York capital. Both of these properties adjoin the Alaska-Gastineau and Gold Belt properties. Prospects are good for the development of these properties in the spring of 1916.

Producing Mines in the Vicinity of Juneau

The Chichagof Mining Co., while not exactly in the Juneau gold belt, being situated on the west coast of Chichagof Island, deserves mention in any Juneau article. This mine presents large workings when one considers that it is a high-grade property, the main ore leads being from 4 to 8 ft. wide. A producer from the start, its output has steadily increased until during 1915 the monthly average was between $50,000 and $75,000, with about 150 men employed.

During the year the capacity of the stamp mill was doubled, new compressor and drill equipment installed and sinking on the vein continued to the 700-ft. level.

In addition to the Chichagof mine, this company operated the old Golden mill during part of the year.

The Eagle River Mining Co., at Amalga, about 40 mi. north of Juneau' continued operations throughout the year until the fall freeze-up cut off the water supply for power.

Late in 1915 a deal was consummated whereby the Eagle River and Yankee Basin properties will be consolidated. This involves a large water-power proposition as well as much development work to put the two properties on a larger production basis. The Pacific Coast Gypsum Co., at Gypsum, succeeded in unwatering its mine during the year and continued the production of gypsum derived from large deposits of this material.

The old Uncle Sam claims at Funter Bay, 20 mi. from Juneau, were again opened up by W. S. Pekovich, under the name of the Alaska Gold Mining Co., capitalized at $1,000,000, and a small production was made in connection with development work consisting of shaft sinking and drifting.

Of the mines some distance from Juneau which are in the development stage, the Kensington and Jualin-Alaska promise the greatest future in 1916. In addition to the 5,000-ft. adit tunnel already driven, further crosscutting and drifting and annual assessment work was done at the Kensington under the management of the Alaska Gold Mines Co., and definite plans were laid for the construction of a 500-ton mill. Work will be started full blast in the spring of 1916 to bring this mine into the producing class.

At the Jualin mine, which closed down at the start of the European War because it is financed by Belgian capital, development work again started in 1915, arrangements having been successfully made for the financing of these operations. Some work was done on the unfinished 7,500-ft. adit, crosscutting was done and stopes cut out, the Deisel-engine equipment, ordered before the war, was installed, and plans were completed for the handling of the great amount of water met with at this property. In December, 1915, about 80 men were employed at this mine.

Some development work was done on the Hirst property, on Chichagof Island, close to the Chichagof mine, a hand-drilled tunnel being driven and five men employed. Some development work was done on the Alaska Copper Co.'s property near Sumdum.

Senator Frank Aldrich sampled and prospected properties in the Auk Bay region and obtained such good results that development of these properties under the direction of Eastern capital is almost assured for the ensuing year.

The Alaska Endicott Mining and Milling Co., whose claims are situated at William Henry Bay, directly across Lynn Canal from the Kensington and Jualin locations, thoroughly investigated its claims and intends developing these with an adequate plant early in 1916. There are numerous prospects that will materialize during 1916, but that cannot be given space in this résumé.

Development of Water-Power Projects

Aside from the Annex Creek power plant installed by the Alaska Gold Mines Co., and the plans for the Eagle River-Yankee Basin power project, there was planned during 1915 a water-power project of vital importance to this field—the Speel River Project, which at present is backed by San Francisco capital and involves the development of 120,000 hp., to be installed by degrees. The size, of the units has not yet been determined.

This work will involve several tunnels and dams to utilize the water derived therefrom. Power will be sold, and it is hoped that an electro-chemical plant will be installed as a direct result of this project. At the close of 1915 the engineers had completed their plans, and work will no doubt be started early in the spring of 1916.

The last year's developments and investigations indicate that before very long Juneau will have taken its place among the largest lode gold-mining camps in the world, and the interest shown by capital in this region is most certainly justified.

Mining in Rhodesia

In 1914 the mineral production of Rhodesia reached a total of £3,870,034, of which £2,800,000 represented the value of the gold output. There were 484 producers; 35 companies produced 67%; 113 tributors, 16%; 336 individuals, 17%. Forty mines produced 75.5% of the output. Companies milled 2,404,235 tons, value 26.10s.; tributors, 575,764 tons, value 26.32s.; individuals, 600,210 tons, value 35.94s. The 40 mines ran various crushing machines, including 492 stamps, 92 Nissens, 26 tube mills, 4 Gates rolls, 4 ball mills, 39 grinding pans and 6 chilean mills. The native labor employed averaged 36,363 per month. Dividends declared reached £514,800, of which £50,655 was from coal mines and £12,000 from chrome mines. Including tributors and individual mines, profits reached £750,000. The value of base metals produced was £302,791, including coal, £115,099, and copper from the Falcon mine, £50,559.

During 1915 the work of the mines was hampered by the departure of many experienced men to the war, by the shortage of machinery and battery spares and by the general rise in prices. Despite these factors the production was well maintained. In 1910 Rhodesian mining had the benefit of a boom, and many new mines were started up with adequate capital and high hopes of large profits. The Consolidated Gold Fields of South Africa has the controlling interest in most of these properties, but so far the results, as regards profits, have been disappointing.

The leading mines of Rhodesia are: The Globe & Phoenix, which, despite patchy development values in the bottom levels, has well maintained its output and the value of its reserves, but its prospects are clouded by litigation. The early administrators of Rhodesia unfortunately adopted the American apex mining law. Fortunately most of the ore deposits of Rhodesia have been of simple structure, and so far no serious litigation has resulted from this law. Now, however, a neighboring company claims the apex rights to one of the richest orebodies in the Globe & Phoenix mine and an interesting lawsuit is in prospect, as there is no precedent here as to the definition of the terms in which the law is expressed. Though the law is undoubtedly taken from American practice, it is doubtful if a British judge would be guided

by American precedents. In August, 1915, 6,245 tons was crushed for a yield of 7,569 oz. and a profit of £18,000. Ore reserves are valued at about £1,300,000.

The Shamva mine is working a large orebody by open quarry and tunnels in a large hill. For the quarter ending June, 1915, 148,202 tons was crushed with a value of £116,575 and a profit of £57,166, working costs being about 8s. per ton. The ore reserves have been reduced from 2,400,000 tons to 1,789,500 tons, valued at 5.43 dwt. The orebody contracts badly in the lower levels, but a crosscut on the 5th level has recently disclosed 40 ft. of ore assaying 6.11 dwt. The plant consists of 56 Nissen stamps and tube mills.

Of the older producers the Giant mine is nearly exhausted and milled 5,800 tons for a yield of £3,591 and a profit of £588 in August. The Eldorado mine suffered from a shortening of the oreshoot on the 5th level; two reefs were payable over a total length of about 1,000 ft. On the 16th level the orebody is 140 ft. long, with a value of 12.9 dwt. over a width of 8 ft.

The Gaika mine, near the Globe & Phoenix, milled in August 3,264 tons for a yield of £7,168 and a profit of £3,039. The ore reserve is, however, only about a year ahead of the mill. The famous Lonely mine shows a lower grade and a shortened orebody in depth. Ore reserves are 135,226 tons, valued at 14.66 dwt. per ton. On the 12th and 13th levels good values have been found. In August 5,000 tons was milled for £11,492 and a profit of £3,892. The Thistle-Etna, which has been milling about 3,000 tons per month, is now nearly worked out; but a new producer in 1914, the Fred mine, has been milling about 2,000 tons per month for a yield of £2 to £2 10s. per ton. The great disappointments as regards profits have been the mines treating refractory ores.

Cam & Motor and Antelope Mines

The Cam & Motor started production with a million tons of ore valued at 40s. per ton developed, and a large and expensive plant for roasting and treatment on West Australian lines was erected after an experimental plant had been run some time. An extraction of 85% was anticipated. Extractions were at first only about 60%, and the expenditure was increased for additions to the plant. Extraction is now about 70%. In August 12,849 tons was treated for a yield of £20,565 and a working profit of £4,401. On the 6th level the orebody shows some signs of shortening in length and values appear more irregular. The Giant mines have taken an interest in the Cam orebody near the Motor orebody.

The Bell Reef Development Co. has a capital of 181,000 shares and owes £54,000, and has erected another expensive roasting plant. The ore takes too long to roast, and an Australian expert is being called in. In 1914, 34,202 tons was treated for a yield of £71,424, showing 82% recovery, but working costs were £60,096. On the 7th level the orebody is 660 ft. long, assaying 9.4 dwt. over 47 in. Ore reserves are 53,007 tons.

The Antelope, with a less refractory ore, treated 4,011 tons for a yield of £8,579 and a profit of £1,990. Costs are 30s. 9d. per ton. On the 12th level the orebody has been developed for 249 ft. assaying 14 dwt. over 61.6 in. Ore reserves are about 50,000 tons. The Golden Kopje has a plant of 60 stamps, 3 tube mills and Burt filter, and treats 12,000 tons per month. The ore reserves are valued at 7.6 dwt. for 290,200 tons, but owing to hanging wall of slopes being soft and caving, the recovery has so far been only about 25s. per ton with a cost of 23s.

The Falcon mines work a large orebody showing auriferous copper glance in quartz. This is concentrated in a flotation plant, and concentrates are smelted to matte, which is exported. Ore reserves are 874,000 tons, valued at 49s. for gold, silver and copper. For the quarter ending June, 38,889 tons yielded metals of a value of £81,343, working costs £73,642, working profit £7,700, capital outlay £15,750. As there is a detention debt of about £200,000, the prospect for shareholders in this and the other companies mentioned is not a brilliant one.

In the Enterprise district, the Planet, Arcturus and Slate mines have developed about 300,000 tons of ore valued at about 45s. per ton, of a refractory character similar to the Cam & Motor, but the Goldfields Development Co. has not yet raised capital to install a plant to treat them. Almost the only other large mine of promise is the Sabiwa in the Gwanda district, which has developed 170,000 tons of 11-dwt. ore.

Unfortunately, few discoveries of either large or small mines are being made. When the present orebodies are exhausted, the output must decline. However, in 1914 a prospector near Bulawayo observed a piece of quartz in a hole dug by an antbear and has now a nice little mine producing gold to the value of £2,000 per month. The Wankie coal mines are supplying coal and coke to the Katanga copper smelters.

Mineral Production of India in 1914

The following figures of mineral production in 1914 are given in the Records of the Geological Survey of India, Vol. XLV, Part 3, 1915, the items being arranged in order of descending value:

Coal, 16,464,263 long tons; gold, 607,388 oz.; petroleum, 259,342,710 gal.; manganese ore, 682,898 long tons; salt, 1,348,225 long tons; saltpeter, 15,489 long tons; mica, 40,507 cwt.; lead ore and slag, 33,685 long tons; tungsten ore, 2,326 long tons; ruby, sapphire and spinel, 304,872 carats; monazite, 1,185 long tons; iron ore, 441,674 long tons; jadeite, 9,925 cwt.; silver, 236,446 oz.; tin ore, 5,395 cwt.; block tin, 1,964 cwt.; zinc ore, (produced by the Burma Corporation), 8,553 long tons; copper ore, 5,324 long tons; garnet, 21,906 cwt.; alum, 8,731 cwt.; steatite, 999 long tons; chromite, 5.888 long tons; clay 54,740 long tons; gypsum, 22,268 long tons; diamonds, 55 carats.

As previously pointed out, these figures differ from those already issued by the chief inspector of mines and given in the *Journal;* the latter apply only to certain mines which come under the Indian Mine Act of 1901, while the figures just quoted give the complete returns collected from all sources.

New Zealand Mineral Exports in 1914 have been officially reported by the Minister of Mines, the principal items being as follows: Gold, 227,954 oz.; silver, 599,162 oz.; coal, 302,908 long tons; kauri gum, 8,473; coke, 17; scheelite, 204 long tons. In addition to the coal exported, 1,972,685 tons was produced and used in the Dominion. In August the exportation of gold was prohibited, so that the value of gold and silver exported does not even approximately represent the total production, which is shown by returns from the mines to be £1,499,072. The total value of the mineral production, including gold and silver won but not exported, was £3,297,984.

Mining in Utah in 1915

By Edward R. Zalinski*

There was unusual activity in mining throughout the state during 1915. More properties were operating, producing or carrying on development than for years previous. Many new companies were incorporated, various claims were taken under option, and the general interest in mining had the effect of bringing about much prospecting and the opening of new orebodies. A new zinc camp was found, interest was taken in two new gold camps, and the production of potash in Utah was begun from the mineral, alunite. On account of advances made in Utah in the metallurgical treatment and milling of low-grade ores, new mills were built to rehandle tailings and old dumps and flotation sections were installed by several of the large producers.

The ore market was good. The valley smelters bought ore, and various buyers representing Eastern companies were in the field. A fair tonnage of zinc ore was shipped in January and February, and the quantity increased steadily. The volume of lead- and silver-ore shipments began to grow larger in April and May. An increased tonnage of copper ore was shipped beginning with the second quarter. The output of all kinds of ore was good in the summer and fall and increased steadily up to December. The tonnage handled was the greatest in the history of the state, amounting to over 12,000,000 tons. The production of gold, silver, copper, lead and zinc exceeded all past records. There were 231 producing mines.

The output of Park City was larger than last year—for the first 11 months showing an increase of over 40%. There were 18 shippers, compared with 12 the year previous. Two new mills—the Big Four Exploration Co., capacity 250 tons, and the Broadwater mill, 500 tons capacity—were built below the camp to treat tailings and produced zinc and lead concentrates. Operations were resumed by the Ontario and Naildriver mines.

The production from Alta and Big Cottonwood increased, there being 14 mines and prospects at work in the latter district. The Cardiff and South Hecla were the principal shippers. A few cars of silver-lead ore monthly were shipped by the Miller Hill, Pacific and others from American Fork. Stockton, Dry Cañon and Ophir showed increased activity, especially Dry Cañon, where numerous leasers were at work, who made zinc- and lead-ore shipments. The Hidden Treasure, Mono Development and Queen of the Hills in Dry Cañon, the Ophir Hill, Cliff and Lion Hill Consolidated at Ophir, and the Bullion Coalition at Stockton made shipments. Two new milling enterprises were started in Beaver County. The Caldo Mining Co.'s mill at Frisco, using the Callow flotation process, was built to treat 200 tons of tailings daily from the old dump at the Horn Silver mine, and began operation the latter part of the year. The Utah Leasing Co. built a mill to treat a 1,000,000-ton tailing dump from the Cactus mill (South Utah) and operated on tailings carrying 0 to 0.8% copper. Tintic produced an increased tonnage of lead, silver, gold, copper and zinc ore, there being 40 producing properties. Many leasers worked in this camp. The Knight-Dern interests built a new mill at Silver City to treat low-grade ores from the Tintic district by chloridizing roasting followed by leaching. This plant should go into operation soon after the first of the year. The Utah Ore Concentrating Co.'s new mill treated dump ore from the Chief Consolidated, Eagle & Blue Bell and Victoria.

The output of Bingham broke all previous records and reached 1,000,000 tons a month in August and September. Wages in this camp were increased 25c. per shift Aug. 1, when copper reached 17c.

Park City, Tintic and Bingham Shipments

Park City shipments for the year were as follows: January, 8,149 tons; February, 9,371; March, 8,829; April, 6,950; May, 8,600; June, 8,911; July, 10,656; August, 8,319; September, 9,096; October, 6,112; November, 6,482; total for eleven months, 91,475 tons.

Tintic shipments for 11 months were: Beck Tunnel, 69 cars; Black Jack, 5; Bullion Beck, 65; Carisa, 30; Centennial-Eureka, 945; Chief Consolidated, 1,010; Clift, 4; Colorado, 49; Copper Queen 1; Dragon Consolidated, 167; Eagle & Blue Bell, 514; Eureka Hill, 35; Gemini, 257; Godiva, 11; Gold Chain, 99; Grand Central, 189; Iron Blossom, 984; Lower Mammoth, 93; McDonald-Huish Sioux lease, 659; Mammoth, 468; May Day, 125; Minnie Moore, 10; Opohongo, 10; Plutus lease, 3; Ridge & Valley, 6; Salvador lease, 1; Sharp mine (McNaughton & Caldwell lease), 6; Sioux Consolidated (Coombs lease), 17; Sultana lease, 3; Tintic smelter, 1; Tintic Standard, 2; Tintic Standard (concentrates), 1; Uncle Sam, 23; United Tintic, 1; Utah Consolidated, 1; Utah Minerals Concentrating, 12; Utah Ore Sampler, 6; Victor, 2; Victoria, 69; Yankee, 50; total 6,003 cars.

The total output for 1915 will be about 300,000 tons.

Bingham shipments for the year were: January, 460,125 tons; February, 544,876; March, 599,339; April, 746,192; May, 896,052; June, 928,682; July, 983,333; August, 1,029,763; September, 1,006,279; October, 993,389; November (estimated), 997,723; December (estimated), 991,231; totals 10,176,984 tons.

Smelting Operations Lively

The United States Smelting Co. at Midvale ran five furnaces on lead ore. This company increased its roasting capacity by the addition of two Dwight & Lloyd roasters and added to its baghouse. The wet concentrator was enlarged from 350 to 600 tons' daily capacity, and the Huff electrostatic plant, from 60 to 100 tons. Metallic cadmium was recovered from flue dust by an electrolytic process. Arsenic was also produced. The Consolidated Fuel, Black Hawk and Panther coal companies' properties in Carbon and Emery Counties were consolidated as the United States Fuel Co., controlled by the smelting company. The Bingham and Tintic mines of this company operated as usual. The American Smelting and Refining Co. at Murray had five furnaces in operation. Both the United States and the A. S. & R. experimented on electro-chemical processes for the recovery of zinc, and the A. S. & R. built a 10-ton trial plant.

The Garfield Smelting Co., of the A. S. & R., operated two blast furnaces and five reverberatories, smelting about

*Mining engineer, Salt Lake City, Utah.

2,700 tons of ore and concentrates daily. This company completed the equipping of its reverberatory furnaces to burn powdered coal instead of oil, though the oil is still held in reserve. The International, at Tooele, had five lead furnaces in blast and two, and at times three, copper reverberatory furnaces. Besides shipments sent by railroad, ores were received by the Tooele plant from the Bingham & New Haven and Utah Consolidated over the Utah Consolidated aërial tramway.

The Utah Ore Sampling Co. operated plants at Park City, Murray, and Silver City, and sampled ores from Utah, Nevada, Idaho, Montana, Oregon, Arizona, California, etc., which shows the territory drawn on by the valley smelters.

Utah Copper Co.'s Operations

The Utah Copper early in the year still curtailed operations. In January only the Magna plant operated, the output being approximately two-thirds of normal; in February the Arthur plant went into operation, when the output was increased to three-quarters of normal; at the end of March both plants were operating at full capacity. In the first quarter 1,396,341 tons of ore was handled, 2,215,159 tons in the second, 2,498,400 tons in the third and 2,445,600 tons (estimated) in the fourth, making a total of 8,555,500 tons for the year, as compared with 6,470,166 tons in 1914. Capping amounting to 5,873,248 cu.yd. was removed. Up to 30,000 tons of ore per day was mined and milled.

The Arthur and Magna plants handled an average of about 27,000 tons per day in the latter part of the year. Further experimental work in flotation was done. The grade of the ore was 1.4393%, 1.42% and 1.4089% during the first three quarters respectively. The extraction was 65.72%, 64.85% and 63.59%. The extraction in the third quarter was lower than usual, owing to partly oxidized ore and to the large tonnage handled. The costs were: 8.188c., 7.49c. and 7.64c. per pound for the three quarters respectively, not crediting miscellaneous income.

The production was: January, 8,009,646 lb.; February, 8,202,467 lb.; March, 10,203,882; April, 12,016,148; May, 14,053,765; June, 14,730,912; July, 14,641,009; August, 15,966,543; September, 14,159,289; October, 16,004,607; November (estimated), 13,807,900; December (estimated), 14,600,000; total, 156,395,168 lb.

The Bingham & Garfield R.R. carried 17,856 tons of ore per day in the third quarter; additional dumping ground for the tailings at the mills and for overburden at Bingham was acquired.

The Ohio Copper, at Bingham, was leased to the General Exploration Co., which operated the mine and mill, treating about 2,000 tons of ore daily.

Production of Gold, Silver and Lead

Gold was produced from copper, lead and mixed ores. Little straight siliceous ore was produced. Discoveries were made at Goldstrike, in Washington County, and at the new camp at Fortuna, in Beaver County. At Fortuna the United States Smelting, Refining and Mining Exploration Co. took a bond on the Lumry & Moore claims and started work on a 200-ft. shaft. A large body of sulphide ore—iron pyrite carrying copper and gold, and galena carrying copper and gold—carrying ½ to 1 oz. gold per ton was developed by the Utah Metal and Tunnel Co. at Bingham, and regular shipments were made. Ore assaying well in gold was mined by the adjoining Bingham-New Haven, which late in the year was bought by the Utah Metal. Lessees at the Annie Laurie mine, at Kimberley, in Piute County, made occasional shipments of siliceous ore. Tintic properties, including the Centennial-Eureka, Eagle & Blue Bell, Chief, Gemini and others, produced from siliceous silver-gold and from lead ores.

The Daly-Judge, Daly West, Silver King Coalition and Silver King Consolidated, at Park City, producing silver-lead ores, and the Utah Apex, Utah Metal and Tunnel Co. (including the Bingham-New Haven), the Utah Consolidated and the United States properties at Bingham, producing lead-silver ores, were the principal shippers.

The Silver King Coalition installed an 80-ton flotation plant (Callow process) at its mill; the Daly-Judge installed Callow flotation to treat slimes and tailings and put in a new steel gallows frame and electric hoisting equipment at the Anchor shaft. The Snake Creek tunnel was advanced to the 13,000-ft. point during the year. leaving 1,500 ft. still to be driven. The Three Kings Mining Co., at Park City, sunk a 540-ft. shaft in Nigger Hollow and crosscut south in promising ground. The Ontario Silver Mining Co. developed some low- and medium-grade siliceous silver ore and made preparations for unwatering the lower levels. Various Tintic mines—the Eagle & Blue Bell, Chief Consolidated, Gemini, Yankee, May Day and others—developed and produced lead and silver ores.

Zinc Ores and Concentrates

Shipments of zinc ores and concentrates were made from Tintic and Park City, while Dry Cañon and Stockton added small amounts. At Tintic the Yankee, May Day, Lower Mammoth, Gemini, Uncle Sam, Ridge & Valley, Colorado, Beck Tunnel, Iron Blossom, etc., mined and shipped zinc ore. Shipments from the camp in the middle and latter part of the year averaged 625 tons a month and at times were considerably more. At Park City, the Daly West and Daly-Judge made zinc concentrates and numerous small tailings plants operated. The two mills—Broadwater and Big Four Exploration—below Park City operated on tailings and produced zinc and lead concentrates. The Daly West made zinc middlings for a time and shipped them to Midvale. The United States properties at Bingham shipped mixed lead and zinc ores to the company's wet concentrator at Midvale, where it was separated and the zinc-iron product treated by the Huff electrostatic plant. The Hidden Treasure, Queen of the Hills and Mono Development, in Dry Cañon, produced zinc ore amounting to 300 tons or over a month during the last half of the year. The Bullion Coalition, at Stockton, also produced zinc. In Beaver County the Cedar-Talisman, shipping 100 tons a month, was the chief producer. The Horn Silver and the Leonora produced some zinc. The Caldo mill at the former property, treating tailings, started operations in December and made zinc concentrates. Small zinc shipments were made from Green River and from Hiram, near Logan, in Cache County.

Important zinc deposits were discovered and developed on Promontory Point, 30 mi. west of Ogden, and a new zinc camp with 15 properties doing development and employing upward of 130 miners resulted. The Lakeview Mining Co., in this camp, located its ground the first of the

year and started work in March. Shipments and dividends began the latter part of May, from which time to the end of the year dividends aggregating $45,500 were paid. Other properties and leasers made shipments. The production of the Lakeview mining district averaged per month over 500 tons of carbonate ores carrying 32 to 35% zinc.

Uranium, Vanadium and Rare-Metal Ores

There has been practically no production of uranium and vanadium ores from Utah since the war started and cut off the market. Development work on carnotite properties in San Juan and Grand Counties was done, and claims were patented. A few odd lots of ore which were on hand were sold in the United States for experimental purposes.

A limited tonnage of antimony ore was shipped from near Marysvale and Junction in southern Utah and from near Lovelock, Nev., being marketed in Salt Lake. One lot of ore carrying 34% bismuth and some gold was shipped from Deep Creek. Tungsten ores were shipped to Salt Lake from Idaho and Nevada. There were also small shipments from Deep Creek (scheelite) and from Bovine, Box Elder County (wolframite). Molybdenum is found at Alta as sulphide or as lead molybdate at a number of properties, including the Grizzly, Alta Gladstone, Albion and Continental Alta, but no ore has even been marketed for this metal.

The production of potash was begun in Utah in October by the Mineral Products Corporation, at Marysvale, in the southern part of the state. The ore is alunite, a basic sulphate of potassium and aluminum, and occurs in large fissure veins. The process consists of crushing, roasting, leaching with water, evaporation and recovery of the potash as sulphate. A plant to treat 100 tons of alunite a day was built and is producing 20 to 30 tons of potassium sulphate daily. Pure alumina is obtained as a byproduct. The capacity of the plant will probably be doubled.

Work was started on a plant for the recovery of potash from the waters of Great Salt Lake. This plant is being built by the Utah Chemical Co., near Saltair, west of Salt Lake City, and will treat the residual liquor from the evaporating ponds of the Inland Crystal Salt Co. Potash and other salts are concentrated in the evaporating pond liquors to several times the percentage present in the waters of the lake. A number of different salts or chemicals are to be recovered, and it is expected to begin operations early in 1916.

A new powder plant of the Hercules Powder Co., at Bacchus, near Garfield, was built and began manufacturing dynamite and black powder for the Intermountain country in March.

The metal production from Utah and custom ores smelted by the United States Smelting Co., the American Smelting and Refining Co., and the International Smelting and Refining Co. was: Gold, 170,836 oz.; silver, 12,512,891 oz.; copper, 174,864,825 lb.; lead, 186,030,225 lb.; zinc, 27,341,830 lb. The output for December is estimated. Arsenic and cadmium were produced by the United States company as byproducts.

Lake Superior Copper District

By C. L. C. Fichtel*

The year 1915 closed with the mines of the Lake Superior copper district working to greater capacity than at any other time in their history. The first quarter of the year was taken up in getting the mines back to normal after the enforced curtailment brought about at the outset of the European War. Wages were returned to their original scale, and at some properties they were increased. The Calumet & Hecla Mining Co. returned to all employees, in the form of a bonus, the difference in money between the reduced scale of wages and the original scale, based on the actual number of days worked during the time the reduction was in effect. All the smaller properties that suspended operations at the outbreak of the war resumed, and the larger properties took on all the available men, so that the labor situation was cleaned up and the district was very prosperous.

The Keweenaw Copper Co. carried on development work on the Ashbed lode at the Phœnix property and opened some very encouraging ground. The Ahmeek Mining Co. put No. 3 and No. 4 shafts into regular commission and started two new heads at the stamp mill to take care of the increased tonnage. A low-pressure steam-turbine generating outfit was also started at the mill. The Allouez Mining Co. rounded into shape nicely during the year and was put on a dividend-paying basis.

Fire destroyed the shafthouse at the No. 2 shaft of the Centennial Copper Co. and caused a curtailment in the production. The Mohawk Co. had a successful year; the mine was put in A1 shape, and costs were materially lowered.

Work was resumed at the Tamarack mine. An examination was made of the property for the minority stockholders and a valuation of the property was made with a view of selling the entire stock to the Calumet & Hecla Mining Co. A proposition was made to the directors, but no definite action was taken. At the stamp mill, plans were laid for the construction of a reclamation plant for the reworking of the tailings piles. A building for this work was erected last year, but all other work was stopped at the beginning of the European War.

At the Calumet & Hecla Mining Co. the No. 2 regrinding mill, together with the hydraulic dredge and classifying house, was put into regular commission, and the results obtained from the reworking of the tailings piles more than met the expectations of the management. The building of the new leaching plant was constructed, all contracts for the necessary apparatus were closed, and the plant will go into commission during the summer of 1916. Ground was broken for the erection of the third large furnace at the smelting works. Both branches of the mine were worked successfully and kept the stamp mills working to their utmost capacity.

*Care of Calumet & Hecla Mining Co., Calumet, Mich.

The Osceola Consolidated Mining Co. completed the erection of a new rockhouse at No. 3 shaft of the old mine, and after being idle for several years, this shaft was again opened. During the later months of the year, a material betterment was noted in the copper contents of the rock. The La Salle Copper Co. resumed operations at both its shafts. The production was small, for considerable development work was done. The New Arcadian succeeded in developing an encouraging formation which offers well for the future of the property. About 3,500 tons of rock was shipped to the stamp mill for three separate mill tests, and it ran better than 20 lb. copper to the ton. The rock was taken from the development openings without any selection.

The Hancock and Quincy companies made an exchange whereby the former secured the use of No. 7 shaft of the Quincy for a portion of each day for the handling of rock from the lower levels, which were extended from the Quincy shaft into the Hancock property.

The stamp mill of the Isle Royale Copper Co., which was destroyed by fire on Christmas eve of 1914, was reconstructed and put in commission during the summer. The mill contains three compound heads and a low-pressure turbo-generating outfit that furnishes the necessary power for operating the washing machinery and the main pumping station. The South Lake property carried on development work and started the erection of the permanent rockhouse. Some small shipments of rock were made to the Franklin Mill.

At the Lake property, operations were resumed. At the close of the year some fine ground was being developed and the management was most optimistic regarding the ultimate success of the property.

The success of the White Pine Copper Co., a subsidiary of the Calumet & Hecla Mining Co., developed a keen interest in the possibility of the Porcupine Mountain district of Ontonagon County. The White Pine Extension Co. started exploratory work with diamond drill and shaft sinking. A formation was opened which will be thoroughly developed.

The equipment of the White Pine Copper Co., which consists of a 1,000-ton mill, power plant and compressor house and rock-transportation system, was put in commission in the early part of the summer and the property put on a permanent producing basis. The two shafts were equipped with permanent hoisting and rock houses. Buildings and equipment and a number of substantially built dwellings were erected for the employees. Railroad connections were made with the Chicago, Milwaukee & St. Paul R.R., and the camp is in a most flourishing condition.

Platinum in Spain

Following the announcement by Sr. Orueta of the discovery of platinum in the Serrania de Ronda, there have been two royal decrees in connection with it, demonstrating the interest taken in the matter by King Alfonso. According to *Madrid Cientifico,* Nov. 15, 1915, the first order charges the geological institute with the formation of a plan of operation for proving the platinum deposit and an estimate of the cost of the work. The determination of the extent of the field in which platinum may be found is also part of this work, establishing limits beyond which prospecting would not be justified.

The second order suspends prospecting in the Serrania de Ronda until the possible platinum field has been delimited as previously mentioned. This provides for a period in which the state may make its necessary investigations and possibly reserve all or a part of the district subject to special conditions.

Men Employed in Anaconda Mines at Butte

BUTTE CORRESPONDENCE

The men employed at the various mines in Butte at the close of 1915 were as follows:

Mine	Surface	Underground	Total
Anaconda	59	750	809
Neversweat	42	62	104
St. Lawrence	50	344	394
Mountain Con.	60	463	523
Bell	77	534	611
High Ore	120	540	660
Belmont	49	164	213
Original	101	557	658
Stewart	48	381	429
Moonlight	13	13	26
Tramway	128	612	740
Poulin	23	19	42
Silver Bow	19	146	165
Berkeley	40	223	263
West Gray Rock	32	162	194
Mountain View	88	774	862
Pennsylvania	58	456	514
Leonard	148	577	725
West Colusa	80	391	471
East Colusa	19	96	115
Badger State	82	464	546
Tropic	14	29	43
Ella	4	...	4
Butte mines' machine shops	212	...	213
Leonard machine shop	214	...	214
Timber framing plant	47	...	47
Sampling works	39	...	39
Butte Reduction Works	7	...	7
Nettie	15	...	15
Modoc	14	...	14
Emma	14	...	14

Depths of Butte Shafts

BUTTE CORRESPONDENCE

The depth of different shafts and development work done in 1915 in mines of the Butte district is:

Mine	Depth in Feet	Feet Sunk in 1915	Mine	Depth in Feet	Feet Sunk in 1915
Anaconda	2,666	0	Mountain View	2,305	0
Neversweat	2,430	0	Pennsylvania	2,442	0
St. Lawrence	2,570	0	Leonard No. 1	2,154	0
Mountain Con.	2,734	0	Leonard No. 2	2,261	0
Diamond	3,330	200	West Colusa	2,272	0
High Ore	3,402	0	East Colusa	1,275	0
Belmont	2,349	0	Badger State	2,390	150
Original	3,169	200	Moose	1,204	400
Gagnon	2,610	0	Tropic	910	0
Stewart	2,987	350	Parnell	1,744	300
Moonlight	1,742	0	Pilot Butte	2,600	200
Buffalo	1,597	100	Butte Alex Scott	2,250	250
West Gray Rock	1,826	200	Black Rock	1,850	250
Silver Bow No. 1	1,033	0	Pittsmont	1,850	58
Berkeley	1,719	100	Colorado	2,550	250
Tramway	2,460	0	Rainbow	1,400	100

Slow Cyanide Poisoning

An unusual case of cyanide poisoning is attracting the attention of physicians, according to reports from Idaho Springs, Colo. John Carlson, a millwright with many years' experience in cyanide mills, was recently employed where he was frequently called upon to repair pipes carrying cyanide solution. It is said that in the performance of his work he was frequently careless of his own welfare and sometimes extended his arms full length into the tanks to adjust a pipe connection or regulate the flow of solution. It is reported that Carlson's whole system appears to be impregnated with the poison, that his blood seems to be undergoing a kind of separation and that all efforts to give him relief have thus far failed.

Flotation Replaces Cyanide

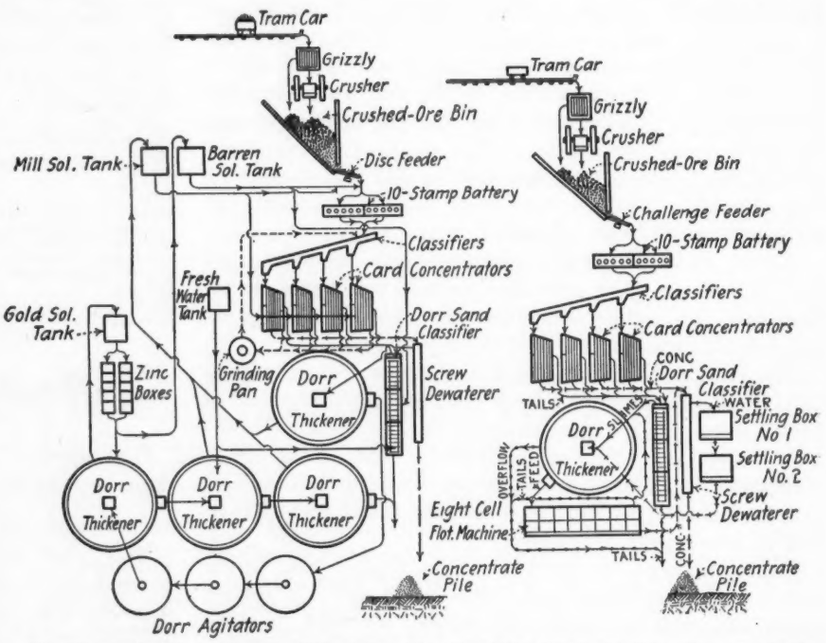
By R. W. Smith*

The principle of ore concentration by flotation has been known for years, but only recently has it attracted serious attention. Flotation has come before the public strikingly in the last year, and many commercial installations have been made. Its spread has been rapid, and it is safe to say that few mills have not experimented or are not experimenting in order to determine what the process may be worth as an assistant to existing methods or as a replacement of them.

If the millman of today finds his ore susceptible to flotation treatment, it is possible that he can increase his total mill saving from a former recovery of 55 or 65% to 90 or 95%. In many cases he can make cleaner concentrates of better grade. He can eliminate all the unsatisfactory slime concentrators, thereby getting rid of their high upkeep cost and the large floor space required. It is true that it costs considerably less to change to mill by a flotation process than to any other form of concentrating mill. In view of all these tempting conditions it is not surprising that flotation has spread rapidly. The two factors, however, which have tended to delay its universal use are, first, the ignorance concerning the details of its practice and, second, the reluctance to work with the process while litigation continues. The first of these factors is rapidly disappearing. As to the second, litigation has continued for such a long period that operators have become restless and are refusing to wait for this to be definitely settled. One of the most recent installations of the flotation process is that of the Oneida Stag Mines and Mills Co., with offices at Idaho Springs, Colo. The mine and mill are at Freeland, an old mining camp about 5 mi. from Idaho Springs. The present mill provides some interesting comparative data—interesting because flotation has displaced the former practice of cyanide treatment.

The ore is typical of the Idaho Springs district. It has been milled for the gold and silver contained in pyrite, gray copper, chalcopyrite and small amounts of galena. In the early days the ore from the mine was high-grade and was then stamped, amalgamated, and a further recovery effected with Gilpin County bumping tables. Part of the old mill is still standing. As the better ore was removed from the mine and the silver market went down in 1893, higher recovery and lower treatment cost became necessary. The Oneida Stag built a cyanide mill for this purpose several years ago, and the first flow sheet shown here indicates the treatment plan. The ore was crushed at the stamps to 8-mesh, concentrated on Card tables, the sand tailings from these tables washed and discharged to waste and the slimes treated with a 2.5-lb. cyanide solution. This treatment gave 92% extraction.

It was found, however, after running several months, that the average total treatment cost per ton of crude mill-feed was 80c. for the cyanide treatment alone. This figure was high on account of the small tonnage treated by the cyanide process and because of the high running expense of the cyanide process, which required highly paid men to operate. There was 50 tons of crude mill-feed per day, and 50 tons of mill-feed produced only 20 tons of slime for cyanide treatment. The costs therefore were prohibitive, and the company could do no more than break even by following the process. In fact, the operators found they could make money by letting this part of the mill stand idle and running only the tables, thereby saving about 65% of the ore value. They decided that it would be necessary to find a cheap and efficient method for treating slimes before they could pay any attention to them. So they ran the stamps and tables for many months—in fact, until flotation came into existence and was brought vividly to their notice and promised a solution of the problem.



FLOW SHEETS OF THE CYANIDE PLANT AND THE FLOTATION PLANT INTO WHICH IT WAS CHANGED

The Installation of Flotation

After a thorough season of experiment the cyanide part of the mill was replaced by a flotation plant. The flow is as indicated in the second drawing. The Dorr thickener and Dorr classifier shown were both part of the cyanide plant and fitted perfectly into the flotation scheme. The flotation machine itself was built in Denver and was shipped in one piece to Idaho Springs. Two weeks after it arrived the feed was turned in, and in a little over three weeks it was making a commercial product.

*Mining engineer, 1845 Grant Ave., Denver, Colo.

The entire tailings from the table floor are run through the Dorr classifier, which eliminates the coarse sands. There are two advantages to this. The first is that the coarse sands contain practically no value, only about 14c. in gold and 15c. in silver, and by removing them, the wear of the flotation machine is considerably reduced. After removing the sands, the slimes are conducted to the Dorr thickener, as shown, where they are dewatered. The thickened pulp as discharged from this machine is elevated to a small box near the first cell of the flotation machine by means of a diaphragm pump. From here the feed enters the flotation machine. The oil is added at this point, but neither acid nor heat is necessary in the treatment.

The flotation machine has 8 cells, or compartments, connected in series, through which the pulp is made to flow by an external method of circulation of special design. The agitation is accomplished by a double agitator driven by a quarter-turn belt for each cell. The agitators in each cell turn in the same direction since they are both fastened on the same shaft, but the blades are turned at such an angle that one impeller opposes the action of the other. The peripheral speed of the impeller is about 1,500 ft. per min. The agitator cells are 18 in. across inside of the lining. The tailings discharged from the eighth cell are reconducted to the Dorr thickener, in which the slimes from the sand classifier are thickened. This is an innovation that increases the recovery materially, and will be discussed in detail.

System of Handling Concentrates

The froth from all eight cells is conducted to a screw dewaterer, into which are also conducted the table concentrates. This is advantageous because the table concentrates are coarse and stack easily and are readily handled. If special product is made of the flotation concentrates, an expensive dewatering system is required, and it may involve an expensive filter press. With the mixing system, the froth goes directly with the table concentrates into the dewaterer. A total of 100 lb. of slime concentrates per hr. is the amount delivered by a flotation machine. The dewaterer removes about two-thirds of the total tonnage of the slimes with the coarse concentrates. Overflow from the dewaterer carries away the other third, which is led to two large settling boxes.

The overflow from the second settling box is led back to the Dorr thickener, thus forming a closed circuit, and none of the concentrates are lost. Nearly all of the remaining third of the slime concentrates that overflow the dewaterer settle in the settling boxes. The insoluble material raised with the mineral is considerable—about 16% in the first cell and about 30% in the eighth, or last cell, making an average of about 24%. There is only a slight penalty for this, and therefore there is not much objection to it. The table concentrates are much cleaner and average about 9% insoluble. After mixing in the flotation concentrates, the total product averages about 16% insoluble, an amount for which the penalty is extremely low.

Table concentrates assay about 1.5% copper, and since the concentrate buyers do not pay for any copper less than 1.5%, this amount is lost. The flotation concentrates, however, run about 3.5 to 4% copper, and so it was thought that an increased profit would be made by a separate production of the flotation froth. After figuring it up, however, it was readily seen that it was immaterial, since 1.5% of the copper is lost whether it is in the flotation concentrates or in the table concentrates. If the two are mixed, the assay is lower in copper but the tonnage is greater, and this offsets the higher assay but lower tonnage of the flotation froth.

Return of the Flotation Tailings

When it was first suggested to return the flotation tailings to the Dorr thickener in which the flotation feed is thickened, it seemed that there were several things that would defeat the purpose. In the first place it might be supposed that the pulp would build up until the thickener would not handle it properly. Or, if this did not happen, it might be that by crowding the thickener with more pulp, the additional pulp would crowd some of the valuable minerals over the overflow lip and they would go to waste. The pulp does gradually build up in the thickener, but this is overcome by allowing the flotation tailings to run to waste through the tailrace one hour in every eight. The other effect is a slight increase in the value of the thickener overflow, but a marked difference in the value of this overflow product and the normal discharge. The flotation tailings average about 40c. in gold and 40c. in silver.

The overflow from the thickener averages about 40c. gold and about 20c. silver. Thus 20c. additional saving per ton is gained by this simple scheme. Considering that the total value of the flotation feed is about $2, this means an additional saving of 10%. When the tailings from the flotation machine are returned to the thickener, the feed to the flotation machine contains six parts of water to one of ore. When these tailings are discharged directly to waste, the consistency is 9 : 1. When the tailings are returned to the thickener, the value of the overflow is about 60c. in total gold and silver. When they are bypassed to waste, the average value of total gold and silver is about 55c., the difference being due to the silver content. Thus, for seven hours out of eight the tailings from the mill are two products, the first of which is coarse sand from the classifier, having an average value in total gold and silver of 55c., and the second of which is the overflow from the Dorr thickener, with total value in gold and silver of 60c. The remainder of the time the tailings are composed of three products, of which the first two are the same as those just mentioned and the third is a discharge from the flotation machine having a total value in gold and silver of 80c. per ton.

Using these figures as a basis on a $2 feed, the flotation recovery is about 70% of its own feed. The additional saving made by this machine in connection with the recovery made by tables makes the mill total recovery about 87 to 90%. This is satisfactory considering the low content of the crude mill-feed.

Flotation Oil and Its Use

Of the flotation feed 85% will pass through a 200-mesh screen and about 90% of the flotation concentrate will pass through the same screen. The oil is added in the small box under which the diaphragm pump discharges just before the pulp enters the machine. Oil is added at the rate of 2.5 lb. per ton of dry feed. The cost has been materially reduced by mixing three different kinds of oil. In this case the mixture consists of

one part of thick crude wood-tar, fairly cheap, one part of spirits of turpentine, more expensive; and four parts of a cheap local mineral oil. This mineral oil constitutes a cheap base for carrying the other oils. It is not always possible to find a mixture that will give a high recovery and at the same time make clean products. By mixing oils as is done at the Oneida Stag, the cost per gallon for oil on the ground is reduced from 45c. to 23c. This reduces the cost of oil per ton of crude mill-feed from 6c. to 3c. The manager of the company, H. T. Rogers, has estimated that the total cost of treatment, including flotation, is $1.85. Of this, flotation costs 35c. The table shows a list of average assays of products in various places as indicated.

VALUE OF VARIOUS FLOTATION PRODUCTS

Sample	Au, Oz.	Ag, Oz.	SiO_2, %	Cu, %
Flotation feed	0.07	2.00	....	..
Flotation tailings	0.02	0.80	....	..
Flotation froth (total 8 cells)	0.60	15.00	24.00	3.5
Flotation, first cell	0.70	17.00	18.00	5.0
Flotation, eighth cell	0.50	13.00	30.00	2.0
Table concentrates	2.25	8.00	9.00	1.3
Dorr thickener overflow	0.02	0.35	....	..
Sand from the Dorr classifier	0.02	0.30	....	..
Mixed concentrates from dewaterer	1.70	11.50	16.00	2.5

In comparing the former cyanide practice with the present flotation-plant work, the advantages of the latter are striking. An effective comparison is made by considering the two flow sheets. In the flotation mill, the discard included three Dorr thickeners, three Dorr agitators, an air compressor for the agitator and a motor to drive it, two zinc boxes, a melting room, solution tanks and the necessary pumps. This amount of machinery represents a considerable outlay of capital, and its saving is material.

The next comparison is in treatment cost. Cyanide costs 80c. per ton of crude mill-feed, or $1.50 per ton of ore actually treated by cyanide. Flotation costs 35c. per ton of crude mill-feed, or 66c. per ton of ore actually treated. The difference between the two, 45c. per ton, represents total profit per ton of mill feed with the flotation machine. The difference in the cost of installation is another advantage in favor of flotation. The actual cost of changing the mill over to flotation from cyanide was only about $2,000. This includes the flotation machine and all labor required to install and connect it properly.

It may be said in conclusion that this installation is only one of the many that are so greatly widening the field of flotation. And its displacement of cyanidation in this mill is suggestive of fields only touched, and indicates possibilities that may lead to revolutionary methods of treatment. Flotation has put the Oneida Stag property back on the map with a bright future, and the mine will undoubtedly be a producer for many years.

Broken Hill Associated Smelters Increases Plant

In order to increase the capacity of its smelteries at Port Pirie up to 5,000 tons of leady concentrates per week, the Broken Hill Associated Smelters Proprietary, Ltd., is spending nearly £100,000, says the London *Financial Times*. When the works were taken over by the present company at the beginning of June, the equipment included 4 Ropp roasting furnaces, 7 Dwight-Lloyd roasters, 16 Huntington-Heberlein converters and 4 smelting furnaces, with mechanical feeding arrangements. The capacity of the smelting plant was 3,200 tons of 60% lead concentrates per week. The lead refinery had a capacity of 2,000 tons of bullion per week. The zinc-smelting works consisted of 1 Matthiessen-Hegeler roaster and 10 zinc-distillation furnaces, with a total capacity of 350 tons of zinc concentrates and an output of 100 tons of spelter and blue powder per week.

The area of land held by the Associated Smelters is 136 acres, of which 127 acres is freehold and the remainder is held under lease from the South Australian government. A wharf 1,200 ft. in length adjoining the works is also held under lease from the South Australian government. In addition there are 18 acres of freehold land at Belambi, N. S. W., 50 mi. south of Sydney, upon which is erected coke works, having a capacity of 1,100 tons of coke per week, shipped to Port Pirie for smelting purposes. The distance by rail between Port Pirie and Broken Hill is 250 mi. The concerns at present sending their outputs to the smelters are the Broken Hill Proprietary, the North and the South companies and the Zinc Corporation.

Tungsten Market in 1915

Until the outbreak of the war the Primos Chemical Co. was practically the only concern that produced tungsten and tungsten alloys in quantities in this country. The placing of war-order business here changed entirely the American position, and the Crucible Steel Co., the Vanadium Alloys Steel Co., the York Metal and Alloys Co., the Wile Electric Furnace Co. and the Goldschmidt Thermit Co. all started active competition for the purchase of tungsten ore so necessary for the shell-making industry.

The market for tungsten ore during the first quarter of 1915 was very poor, and it fetched only $6@9 per unit. Very little foreign ore reached this country, and the demand was not up to the normal. During April and May the allies placed in this country enormous orders for war requirements, and the demand for tungsten became great. Not foreseeing the call that would be made for the ore, contracts were closed by many dealers at between $7 and $9, but unfortunately the persons with whom the contracts were closed did not make good in all cases, and many a contract that was closed at those figures is still awaiting completion. The fulfillment of the contracts closed at those low figures is said to be rather the exception than the rule. During May the price reached $10 per unit. It continued rising by leaps and bounds until it became simply a question as to who had the tungsten ore. Whoever had it could demand his own price, which was paid by the buyers without any counter-offer for fear lest they might lose the parcel. However, the British government lost parcels by trying to dicker for them in what was not a dickering market.

Buyers here sent agents to Japan and to South America to get whatever tungsten ore might still be had, as the several interests in this country were competing with each other, driving the market up against themselves. By October the price had reached $40 per unit.

Previous to the outbreak of the war, Australia, New Zealand, Burma and the Straits Settlements supplied a very large proportion of the world's production of tungsten. England, foreseeing the call for this ore, com-

mandeered all that was produced in any of its colonies, and fixed a maximum price of 55s. per unit. or about $13.50. Though this requisition stopped any tungsten reaching this country from the British Colonies, it cleared the position considerably as far as neutral countries are concerned, for the British no longer competed for the ore which fetched here a very much higher figure than the maximum price fixed for the British government.

However, the British embargo did not operate wholly as expected. Many colonial producers did not relish the selling of their product for a price only one-half or one-third of what was being paid in the open market and reserved their output with the expectation that the British government would have to raise its figure at some time.

American consumers of tungsten ore obtained considerable supplies from Mexico and South America. Portugal and Spain are also producers, but the mines there are controlled to a large extent by British capital. Those mines that were not subjected to British dictation encountered considerable difficulties in getting tungsten shipped to the United States. Only during the last few weeks have arrangements been completed by which tungsten ore contracted in Portugal and Spain may now be shipped; the first shipment of fair quantity was to leave for New York during December. Japan shipped tungsten ore to this country when the price had reached $44 per unit, at which figure large quantities were booked during December. Later sales of ore in quantity were made in this market at $50 per unit. These were contract prices.

Ore for prompt delivery is so very much in demand that practically any price is being paid. Although the largest buyers here will not pay the top prices, ammunition makers have paid as much as $62.50 per unit, or even more. Such high prices have stimulated every prospector to look for tungsten, and on the other hand have induced mine owners to work their mines to their full capacity. Tungsten ore assaying only 2 to 4%, which was hardly worth while mining in normal times, is now finding a ready sale, while 5% ore has fetched $28 per unit. Dumps have been re-treated to get whatever they would yield. Anything containing tungsten has been hunted for. Assayers' offices have been ransacked for forgotten samples of the ore. A single pound has been readily marketable, and opportunities to get 100-lb. lots have been thankfully received by the largest buyers.

The value of tungsten metal advanced from 60c. per lb. to $7 per lb. during the year. Tool steel that used to be worth about 70c. per lb. is eagerly bought at $3 per lb. These stupendous advances have not curtailed consumption. On the contrary, the largest works in the United States, which took about 100 tons of tungsten ore per month at the beginning of 1915, was taking 200 tons per month at the end. The cessation of importation of tungsten powder and magnet steel from Germany placed the American producers of those materials in a favorable position so long as they could get the raw material.

As to what is going to happen in this industry after the war, opinions differ. One view is that it is threatened with dire disaster. Another is that there will not be an immediate recession of the price, most of the ore that could be secured having been contracted for months and months ahead.

British Zinc-Smelting Plan

We understand, says the *London Times,* that within the next day or two the committee which has been invited by the Colonial Secretary and the president of the Board of Trade to elaborate a British spelter scheme may be expected to hold its first meeting for the purpose. The committee, which is representative of the different interests, is not even committed to the principles of a single scheme, for when the deputation was received at the Colonial Office a few days ago the ministers were informed that the outlines of two schemes had been discussed. The first provided for the payment of a government bonus if and when the price fell below £23 per ton, and the other for a government guarantee of interest on new capital expenditure, and the committee, so it was pointed out, was probably slightly inclined toward the bonus system. There seems reason for thinking that if a satisfactory bonus scheme were prepared, the government might not be unwilling to subscribe a substantial amount, say £500,000. Then if the ore-producing companies in Australia were ready to subscribe another £500,000 it would seem not unreasonable to invite the great users of spelter in this country, the brass and corrugated iron manufacturers and other interested companies, to subscribe a further £500,000.

With a capital of £1,500,000 large new smelting works could be built, presumably in the neighborhood of coal fields, for about three tons of coal are required for every ton of ore smelted. No relief to the spelter situation could be given for some time, since the building of works would take between a year and two years, according to circumstances, and the labor problem would call for special care. Possibly a garden city would form part of the plan. If, as might fairly be expected, government contracts over a period of years were forthcoming, the scheme would start with a measure of support; but clearly the bonus system would have to be protected against the dumping on the market of the German surplus production. What dangers were latent in the old dependence on Continental exports has been proved by the experience since the outbreak of war, for, the German exports having ceased, this country was for a time faced not only with enormous prices, but with a positive famine of spelter. One great merit of the bonus system would be that no difficulty would occur in dealing with existing works; they would participate, like new works, in any bonus distributed and might even look to recoup themselves for past losses, whereas under an interest guarantee system special allowance could hardly be made for past deficits.

Coeur d'Alene Production for 13 Years

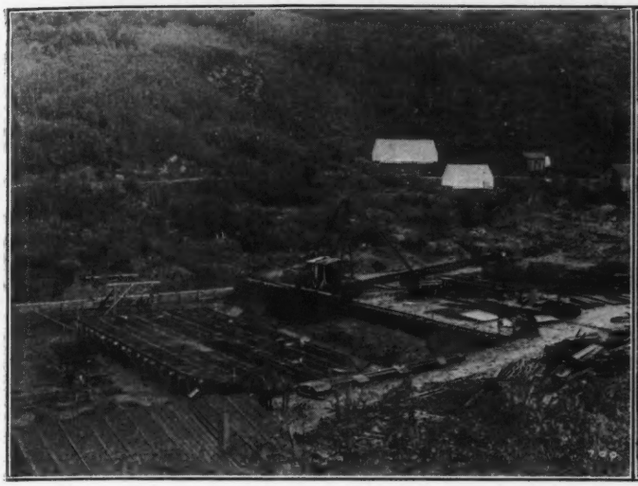
The total production, costs, etc., of the Cœur d'Alene producing mines for 13 years to Jan. 1, 1915, is given by the *Wallace Miner,* from whose compilation that figures in the grand total column of the table are taken; the figures in the last column are computed therefrom.

	Grand Totals	Per Ton
Tons extracted	36,430,777	...
Gross value	$175,905,382	$4.83
Cost of extraction	60,215,784	1.65
Transportation and reduction	51,820,621	1.42
Improvements and repairs	8,995,857	.25
Net profit	45,910,282	1.26

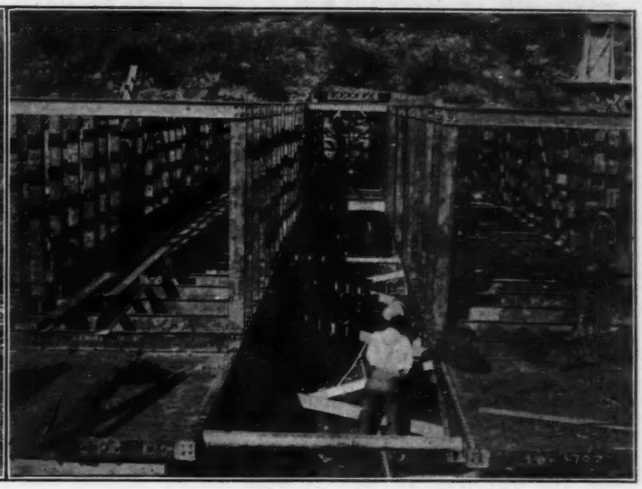
Photographs from the Field

STEEL HULL AND SUPERSTRUCTURE OF YUKON NO. 9 DREDGE ASSEMBLED IN CONSTRUCTION YARD BEFORE SHIPMENT

During the season of 1911 the Yukon Gold Co. built two all-steel dredges having 7½-cu.ft. buckets. These dredges each weighed over 1,340 tons and required more than 55,000 rivets in their construction. For their size, they are probably the heaviest dredges ever built, having been constructed to withstand the severe duty imposed by the conditions in the Yukon. Bedrock must be dug and occasionally unthawed areas are encountered. Since dredging was initiated in the Yukon, many detail changes have been made in the dredge machinery. Certain parts were found to be inadequate for the severe conditions encountered in this field. The buckets have been redesigned several times since operations started. Digging ladders have been reinforced and heavily shod on the bottom, screens rebuilt, pump capacities increased, sluices and gold-saving apparatus changed. When the Yukon Gold Co. built its all-steel dredges it had the benefit of several years' actual operating experience and incorporated these improvements in its new dredges



July 27



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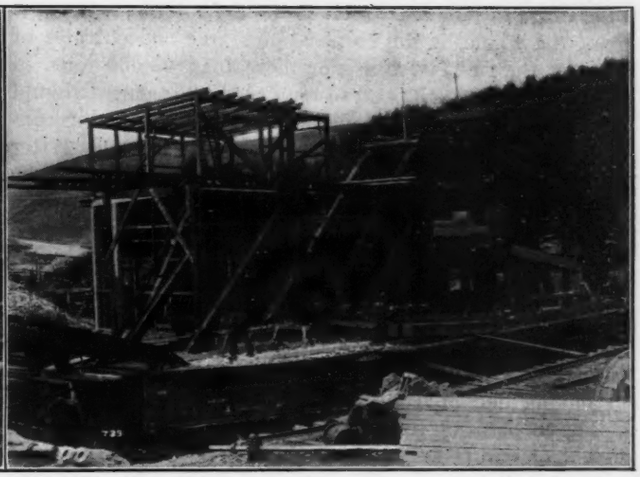

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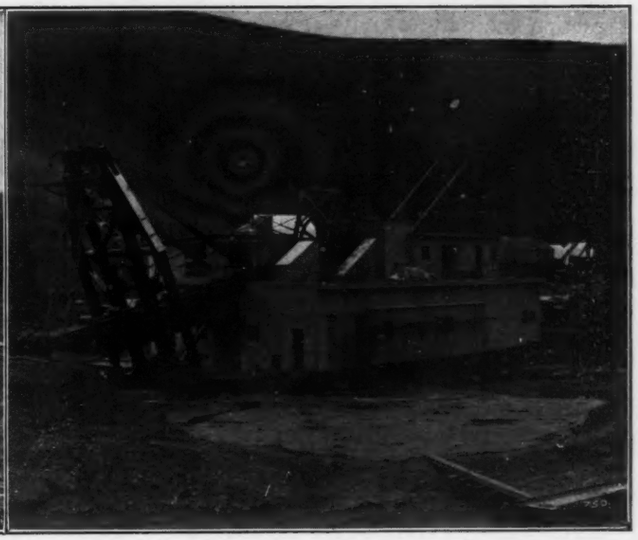

Sept. 27

PROGRESS PICTURES OF CONSTRUCTION OF YUKON NO. 9 STEEL DREDGE

Construction of this dredge was begun on July 20, 1911, and was completed on Oct. 5, going into commission Oct. 7. No. 8 steel dredge, built simultaneously, was completed in 63 days; it has been dredging on Upper Bonanza Creek since 1911

Hirsch Loses Appeal Against Zinc Corporation

On Dec 21, in London, the Court of Appeal, composed of Lords Justices Swinfen Eady, Phillimore and Pickford unanimously affirmed the decision of Justice Bray declaring void a contract by which Aron Hirsch & Sohn, of Halberstadt, Germany, agreed to buy from the Zinc Corporation the zinc concentrates produced at its Broken Hill mines from 1910 to 1919, and by which it was further agreed that the corporation should not sell zinc concentrates to other persons, says the London *Financial Times.*

Their Lordships declined to entertain the contention put forward on behalf of the appellant, Aron Hirsch & Sohn, that the contract was merely suspended for the duration of the war, and held that it was dissolved as from the outbreak of war between Great Britain and Germany on Aug. 4, 1914.

Lord Justice Swinfen Eady, in the course of a lengthy judgment, said that by the contract the plaintiff, the Zinc Corporation, was to sell to the defendants, a German firm, the whole of the corporation's zinc concentrates of not less than 85,000 tons nor more than 95,000 tons, in each year up to 1919; and so long as the agreement should be in force the corporation was not to sell any zinc concentrates to any other firm, corporation or person. After the outbreak of war the corporation discontinued, and the defendant declined to accept delivery of concentrates, and by reason of the contract the corporation had since been placed in a position of much difficulty. It could not make forward contracts for delivery elsewhere until its legal position had been determined. Furthermore, if upon the restoration of peace the corporation was called upon to deliver to the defendant, it might run short by reason of having delivered elsewhere.

The corporation contended that the effect of the war was to put an end to and dissolve the contract; the defendant said that it was merely suspended during the war and would immediately become operative again at the close of hostilities. Having examined the contract in detail, his Lordship said that, in his opinion, upon its true construction the outbreak of war had dissolved the contract between the parties so far as regarded further performance after Aug. 4, 1914, and that the remedy of either side as to what had previously been carried out remained in abeyance until the determination of the war. But there remained another point of view from which the matter must be considered. The defendant could not take delivery, and yet according to the contract the corporation could not sell its products elsewhere, and thus the whole of this great industry must be brought to an entire standstill. The effect of such a provision upon an important commercial enterprise was to prevent the resources of the country being developed, labor being employed, the value of the metal being realized and the proceeds being utilized in the best interests of the country. Furthermore, it would enable the defendant, an alien enemy, to resume its trade immediately after the declaration of peace, and so diminish the effect of the war upon the commercial prosperity of the enemy country which it was the object of this country during the war to destroy. It would be to undo by a British tribunal the work done for the nation by its naval and military forces. In his opinion such an agreement was void as tending to assist the King's enemies, and to act upon it would be little removed from trading with the enemy. Such a contract was just as illegal as if it had been expressly forbidden by Act of Parliament. The true answer must be that the contract had become not suspended but dissolved by the war, and the judgment of the court below must be affirmed and the appeal dismissed with costs.

Lords Justices Phillimore and Pickford concurred.

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Columbia's New Professor of Mining, Robert M. Raymond*

By Arthur S. Dwight†

The trustees of Columbia University at their meeting of Jan. 3, 1916, appointed Robert Matthew Raymond, Class of '89, professor of mining in the School of Mines, thus filling the chair made vacant by the retirement last June of the veteran Prof. Henry S. Munroe, after 37 years of service. This appointment is unquestionably one of the most important that has been made in the School of Mines in several years, not only because mining is naturally its pivotal course, but by reason of the eminent professional standing, the character and personality of the new incumbent.

Among her many distinguished sons who have carried Columbia's traditions into the far corners of the earth, few have had a wider or more successful experience, and certainly none has earned a higher meed of affectionate regard from his associates, employees and brother engineers, than Mr. Raymond. Whatever his task, whether directing practical mining operations, examining and reporting on mines, acting as managing director in a foreign country or as the expert adviser of boards of directors in the financial centers of the world, Mr. Raymond's executive ability, resourcefulness, personal initiative, good sense and tact have brought him success and distinction.

South Carolina, Montana, Arizona, Australia, South Africa, China, Mexico, London, New York—these fields of activity indicate the wide range of mining conditions with which he is acquainted, the scope of the problems he has faced and solved, and furnish a measure of the splendid equipment he brings to the new and somewhat untried task to which he has now, with characteristic devotion and enthusiasm, dedicated himself—that of putting his experience and talents at the service of his Alma Mater.

Fully as important as technical skill should be reckoned his rare personality, his characteristic alertness and enthusiasm for any enterprise that his well-balanced judgment will sanction, his contagious good nature, and finally, his deep sympathy with the Spirit of Youth. His accession can hardly fail to have a great and favorable influence on the future of the School of Mines.

Robert Matthew Raymond was born in Norton, New Brunswick, Canada, and received his A.B. from the University of New Brunswick. Before entering Columbia School of Mines, he had the advantage of an interim of several years of practical work, which gave him the opportunity of forming his ideas and deliberately choosing mining as his profession. He taught for a short time in the Fredericton schools, was assistant assayer in the

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Assay Office of the State of Maine and spent four years at the Haile Gold Mines in South Carolina, under the well-known engineer, E. Gybbon Spilsbury. He then attended the School of Mines, graduated with the Class of '89 and immediately entered the service of the veteran metallurgist, Anton Eilers, who had then built the Montana Smelting Co. at Great Falls, Mont. Here Mr. Raymond was first assayer and later assistant to Robert Sticht, then superintendent, whose fame as a metallurgist is well known.

From 1891 to 1894 he was superintendent of the Diamond R Mining Co., at Neihart, Mont., and then for two years general manager of the Harquahala Gold Mining Co., in Arizona, owned by an English company in whose interest he later went to Western Australia. While there, in 1898, he was engaged by the famous Exploration Co., Ltd., of London, one of the most successful and conservative of the great English mining syndicates and one which has been identified with large mining operations in all parts of the world. That connection has been continuously maintained to the present time and, under the arrangements that have now been made, will not be entirely terminated by his appointment to the Columbia Faculty.

From Australia Mr. Raymond was sent to South Africa, where the Exploration Co. had large interests, having been among the first of the large companies to appreciate the enormous possibilities of deep mining on the Rand. He remained there about two years. In 1901 he made some important examinations for his company in central and western China.

In 1902 he became general manager of El Oro Mining and Railway Co., of El Oro, Mexico, probably the largest gold-mining property in Mexico, and controlled by his company. The pioneer plant of the cyanide process in Mexico was built at El Oro, and it was during the period of Mr. Raymond's management that the practice of that process was worked out so successfully in El Oro mill that it was adopted as standard not only in Mexico, but in many other mining regions of the world. Mr. Raymond gives most of the credit for this success to another School of Mines man, A. F. Main, who studied with the Class of '95 and who is now general manager at El Oro, as Mr. Raymond's successor.

The management of a large mining property of this kind in a country like Mexico is nothing short of a school of statesmanship, for the industrial side of the problem is often overshadowed by the broader aspects, involving not only the well-being of the community dependent upon the enterprise but many political considerations that require the exercise of considerable diplomatic skill.

In 1906 Mr. Raymond was promoted to be managing director of El Oro company and also of the Exploration Co. of England and Mexico, a subsidiary of the parent company. This required him to take up his residence in Mexico City, where his beautiful home still stands unmolested. Except for a trip to South America early in 1914, when he made an examination of the great copper properties of Chile, especially the Chuquicamata and Braden, Mr. Raymond remained in Mexico during most of the turbulent period of the present revolution and bore his part in the activities which the foreign colony found it necessary to organize, not only to safeguard their own lives and property, but to give aid to suffering Mexican families during those trying times. Mr. Raymond was prominent as an officer of the International Committee. Of this interesting episode, the most exciting portion occurred in the early part of 1915, when the Carranza, Villa and Zapata factions were contending for the mastery of Mexico City.

The Exploration Co., Ltd., has been very loath to lose the services of Mr. Raymond, and he would probably have felt compelled to decline the offer from Columbia out of loyalty to his associates, had not the chairman, R. T. Bayliss, for many years his chief and warm personal friend, made it possible for Mr. Raymond to take up the work at Columbia and yet continue to serve the Exploration Co. in an advisory capacity, as engineer and also as director of El Oro company. This makes an ideal arrangement for Columbia, as it insures Mr. Raymond's keeping in close touch with the mining world. Columbia University certainly owes a debt of appreciation to Mr. Bayliss for his friendly attitude.

Mr. Raymond married Miss Grace Lovejoy, of Boston, Mass., who has shared many of his interesting experiences, particularly in Mexico. He is a member of the American Institute of Mining Engineers, the Mining and Metallurgical Society of America, the Institution of Mining and Metallurgy of London and the Engineers' Club of New York.

Nitric Acid from the Air

James B. Duke, of the Southern Electro-Chemical Co., announced that that concern will place on the market nitric acid obtained from the air at a price far less than the present process can produce, says the New York *Sun*. This may furnish the need felt by the Federal Government for cheap nitrates in the manufacture of gunpowder. Four tons of nitric acid, Mr. Duke declares, will be produced from the air every day.

In the development of the acid the Pauling process is used. This process was invented in Austria, and it is said that by it the Central Powers are obtaining their nitrates for war use.

Brig.-Gen. William M. Crozier, Chief of Ordance of the United States Army, urged in his annual report steps to make the Government independent of the great Chilean nitrate beds.

If cheap water power can be obtained, Mr. Duke's company is prepared to increase its product and reduce the cost of its nitrates. In this process the air is superheated by electricity and the nitrogen is released. The plant now used is at Great Falls, S. C., 50 mi. from Charlotte, N. C.

Land Office Denies Patents for Searles Lake Potash Land

Commissioner Clay Tallman of the General Land Office, in two letters under date of Dec. 13, 1915, has directed the register and receiver at Independence, Calif., to enter adverse proceedings against the California Trona Co.'s mineral applications Nos. 04,104 and 04,064 for certain placer-mining claims at Searles Lake. The first application covers 5 claims of 20 acres each, and the second is for one association claim of 160 acres. These claims contain sodium carbonate, sodium sulphate, sodium borate, sodium chloride, potassium chloride and other minerals, but their chief interest is in the potash-bearing

brine which constitutes the principal commercial source of potash in this country.

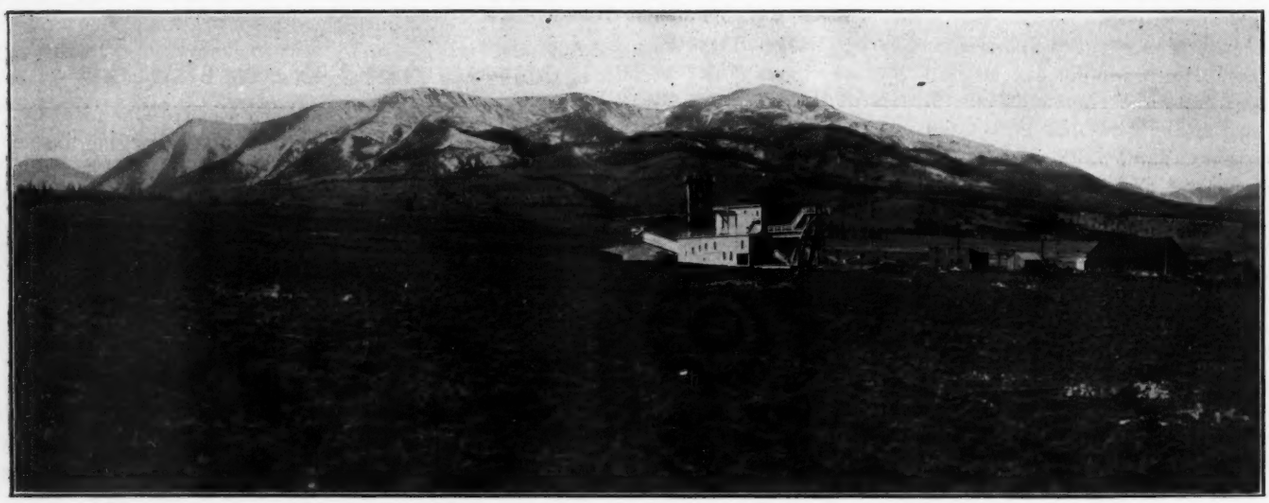
The main reasons cited by the mineral inspector for the adverse proceedings are: (1) That the land "does not contain a mineral deposit of such form and character as to bring it within the mining laws of the United States, and is therefore not subject to entry or disposal thereunder;" (2) that the locations were not made in good faith, but for the benefit and in the interest of nonresident aliens who under the law are not qualified to receive a patent from the United States. There are numerous minor citations regarding the location of the claims, such as improper filing, defective posting, etc. Should the position of the Land Office be sustained, these potash lands will not be open to relocation, as they are embraced in the area withdrawn by the Executive Order of Feb. 21, 1913, and placed in Potash Reserve No. 2.

The first contention of the Land Office, that these claims do not contain a mineral deposit of such form and character as to bring it within the mining laws, seems rather extraordinary, especially in view of the fact that petroleum locations have been, and still are, made under these laws. The other contention, that the Trona patent applications are made for the benefit of aliens, appears more tenable and may eventually open the way to Government leasing of the Searles Lake deposit, under the proposed public-land leasing bill.

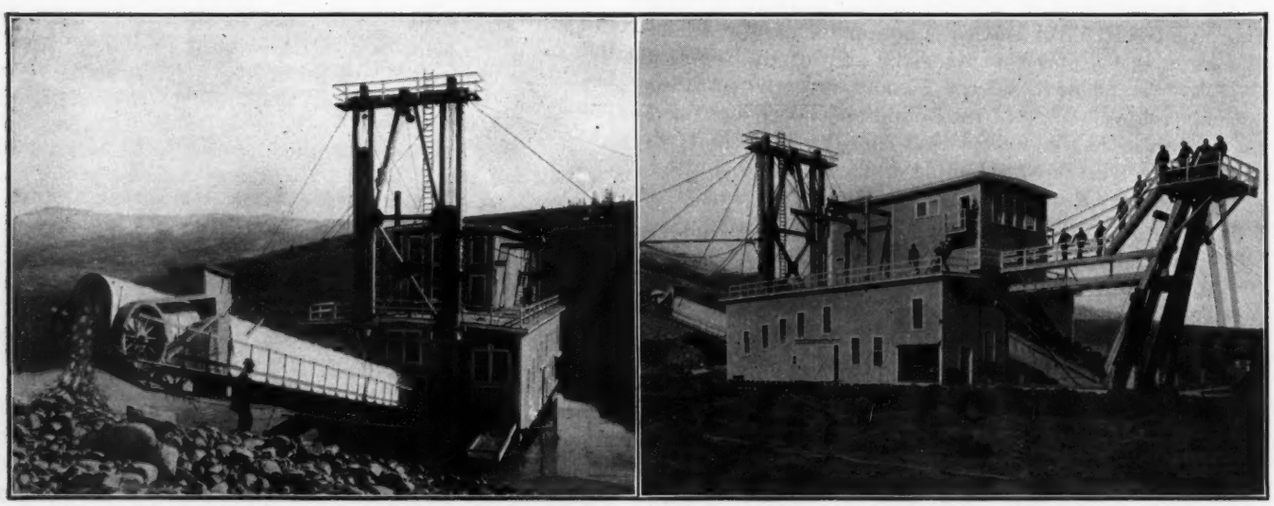
Derry Ranch Gold Dredge

The Derry Ranch Gold Dredging Co. has under lease 2,000 acres of ground known as the Derry ranch, about 12 miles south of Leadville, Colo., in the Arkansas Valley. The company's 5½-cu.ft. dredge began operating in October, 1915, and closed for the season in December. During this two months' period the dredge recovered over $1,000 a day, while the operating expenses were only about $3,500 a month. The dredge was closed down Dec. 10, owing to the extremely severe climatic conditions, which caused considerable increase in the operating expenses.

The ground was originally drilled by W. H. Radford and was subsequently checked by Robert F. Lafferty. The actual recovery was about 15% more than the prospecting estimates of this ground. The total cleanup during the two months' run in 1915 amounted to $69,370, or



DERRY RANCH GOLD DREDGE IN ARKANSAS VALLEY, 12 MI. SOUTH OF LEADVILLE, COLO.



TWO VIEWS OF THE 5½-CU.FT. DERRY RANCH DREDGE

This dredge cleaned up over $1,000 per day before closing for the season on Dec. 10, 1915. Note the size of the boulders handled without interruption to operations; running time of dredge averaged 22 hr. per day

approximately 50c. per yd. for 140,000 cu.yd. handled. These highly satisfactory results will doubtless cause some envy on the part of engineers who have traveled down this valley many times during the last 40 years.

The Derry Ranch dredge was erected last summer by the New York Engineering Co., of 2 Rector St., New York. A. C. Ludlum, president of the construction company, is also president of the dredging company and is the largest stockholder. The dredge was rebuilt, having been purchased from the old Magpie Gulch Dredging Co. in Montana, where it had operated about a year, but had not been a commercial success. It was dismantled and shipped to Colorado and brought up to a high state of efficiency by various improvements, the gold-saving area on the dredge having been doubled. The complete installation cost about $108,000, which indicates little profit in transporting and rebuilding a dredge. The chief advantage in this instance was prompt delivery, permitting two months' operation last season. The remodeled dredge operates on about 150 hp., and has averaged nearly 22 hr. per day, whereas in Montana the daily digging time was only about 15 hr.

The accompanying illustrations show the dredge in its picturesque situation; a feature of interest is the size of the boulders that were handled, with almost no interruption by the 5½-cu.ft. buckets. Few tailing piles from 5- or 6-cu.ft. dredges show boulders of this size in the United States. In Alaska and some other regions, boulders of even larger size are encountered, but their handling entails delay and reduced yardage.

The Derry Ranch dredge will be placed in operation as early as possible next spring. The prospecting campaign has indicated that when she begins operations in 1916 she will be in as rich ground as was dug last autumn.

Mexican Bandits Execute Sixteen Americans

According to a dispatch from British Vice-Consul Scovell, of the City of Chihuahua, to Consul H. C. Myles, of El Paso, 17 American miners were taken from a Mexican Northwestern train, robbed and stripped, and then shot near Santa Isabel by Mexican bandits on the night of Jan. 10.

The news was brought to Chihuahua City, says the New York *Sun*, by T. B. Holmes, one of a party of Americans who left there Monday morning. He was the last man on the end of the line stood against the wall and succeeded in slipping away and reaching Chihuahua. As he ran through the underbrush he heard the shots of the firing squad.

Mr. Holmes says that the train was stopped in the early morning by heavily armed Mexicans. The Americans were compelled to leave the cars. They found themselves in a little depression thickly covered with mesquite trees and underbrush. Brought before the commanding officer, whom Mr. Holmes did not know, the mining men were searched and stripped. Then a line of Mexicans formed on each side, the word to advance was given and the Americans were marched to an adobe hut a quarter of a mile distant.

A few prayed as the Mexican firing squad drew up in front of them. It was then that Mr. Holmes, at one end of the line, took advantage of some confusion among the Mexicans and slipped around the corner of the house unobserved. He made his way across the desert to Chihuahua, after securing clothes from friendly Mexicans on the outskirts of a village, and telegraphed here.

The party was in charge of C. R. Watson, general manager of the Cusi Mining Co. This party left El Paso Saturday for Chihuahua. A message was received Monday saying that the mining men had arrived in Chihuahua safely and planned to leave some time Monday for Cusihuirachic to begin operations. This was the last heard of them until a message was received at the offices of the company reporting their execution.

The complete list of Americans who left El Paso is as follows: Charles R. Watson, general manager of the Cusi Mining Co., and chairman of the committee of the Mine and Smelters Protective Association formed at Chihuahua to protect the property of mining and smelting companies in the State of Chihuahua; W. J. Wallace, superintendent; M. B. Romero, office man, who formerly was with the Madera company and who is a New Mexican; Tom M. Evans, storekeeper; C. A. Pringle, mining engineer of San Francisco, formerly general manager of the Calera Mining Co. at San Isidro, Chihuahua, and of the Tintic Mining and Development Co. at Bingham, Utah; Maurice Anderson, clerk, son of Roland Anderson, secretary of the Chihuahua Foreign Club; R. P. McHattan, of El Paso, a stenographer; J. P. Coy, a mill man; Alex Hall, a mill man; Charles Wadleigh, a mill man; E. L. Robinson, an assayer for the company; G. W. Newman, a mining engineer; H. C. Hase, a mill man; I. Adams (not known); R. H. Simmons, master mechanic for the Cusi Mexicana Mining Co.; W. D. Pearce, manager of an independent mine; Murray F. Crossette, formerly manager of the Cusi Mining Co. and of the Minas San Juan y Anexas, and J. W. Woon, residence unknown.

General Manager Watson lived in El Paso. He was married only six weeks ago and brought his wife to El Paso from Kansas. The Cusi mines are among the richest in northern Mexico. They are owned by the Potter Palmer estate, of Chicago, and developed into a bonanza soon after they were bought by the Palmer interests five years ago. It is believed here that the men were killed by troops under Gen. José Rodriguez, a follower of Villa, and with the approval of Villa.

The Americans are said to have been sent to reopen the mines on assurances of protection to the company given by the Carranza government through the United States State Department. After the first news of the raid was received a censorship was imposed on the wires between Juarez and Chihuahua City by the Carranza officials, "until the story could be verified from official Mexican sources," it was said.

Cost of Seneca-Superior Silver

The operating costs per ton and per ounce, at the Seneca-Superior mines, Cobalt, Ontario, from June to October (1915) inclusive, were as follows:

	Cost per Ton of Ore	Cost per Oz. of Silver
June	$4.25	$0.096
July	3.05	.069
August	3.07	.063
September	3.36	.048
October	3.55	.048

The Reason

THERE'S a miner is dead and another in jail
With the mark of Cain on his brow;
It's the same old ugly and brutal tale
Of a horrible drunken row;
For they'd both be back at their job today
With the rest of the working crews,
Soberly earning their miners' pay,
If it wasn't for booze.

Bill Smith is only a drunken shine,
A sodden and blear-eyed tramp,
Yet he once knew more of the way to mine
Than anyone else in camp;
And he might be boss of a mine or so
And getting a foreman's dues,
Instead of a moocher, vag and "bo,"
If it wasn't for booze.

Jim Jones came back from a drinking spell,
And his head was dull and hot,
And so it happened he failed to tell
Of the hole he hadn't shot;
There is one man blinded and two men dead
Because he forgot that news,
Yet they'd all be living and well instead,
If it wasn't for booze.

If it wasn't for booze, why the wives who sigh
Might smile in their joy and peace,
And the sound of the children's hunger-cry
Would dwindle and fade and cease;
We'd have less dirt and rags and more
Of clothing and food and shoes,
We'd earn more pay and we'd mine more ore,
If it wasn't for booze.

Written Expressly for The Engineering and Mining Journal by Berton Braley

Editorials

Zinc Smelting in Great Britain

The reason for the sluggishness of Great Britain in developing an enlarged zinc-smelting industry in her time of need is being revealed. It is simply the fear that after the war its smelters cannot hold the business, that the Germans will step in and take the Australian ore again by offering to smelt it more cheaply than the British can, and that consequently new investment in plant in Great Britain will be lost. Wherefore such fear? Great Britain has all the advantages of raw material and markets that the Germans have. The ore originates in British mines and is brought over the seas in British ships. What is the drawback? Simply the inefficiency of labor, the blighting influence of British trade unionism. A movement is now on foot to get around this by having the government bestow a bounty upon spelter production. Judging from British press reports, this project is regarded rather favorably by the government.

In this the British are beginning to see straight, but they have not yet become quite honest. A little while ago they were blackguarding the German metal houses for capturing the Australian business, charging conspiracies and all sorts of evil things, but now are admitting that after the war the ore is likely to go the same way just for the reason that it may be the more economical way (as it was previous to the war). Nor is it honest to charge "that the authorities had paid to the American producers (of spelter) and speculators who bled them (the authorities) more money in extortionate profits since the beginning of the war than would have been required to erect and capitalize sufficient plant in this country (Great Britain) to produce enough spelter for all our present and future requirements."

This is equivalent to saying that the American zinc producers put up the price for spelter to mulct the British government. In fact the American consumer of spelter has had to pay the same prices, and inasmuch as domestic consumption has been larger than the British taking—probably larger than the total military requirement—the users of spelter in this country might reasonably complain that the failure of the British to make their own spelter rendered conditions uncomfortable, even disastrous, to many innocent persons here.

Hindsight is always easier than foresight. It is a simple matter to look backward and say what ought to have been done. Unfortunately nobody can put himself backward to do it. The United States Smelting Co. about the middle of 1915 bought a group of old, moribund zinc smelteries in Kansas, at a time when other adventurers were doing the same thing. That company has just stated officially that it has already recouped two-thirds of its investment and expects to be "on velvet" about Mar. 1, 1916. It was open to the British government, to British capitalists or to British zinc-mining interests to do the same thing a year ago, or even nine months ago, and put themselves in the position of American producers, speculators, etc. Indeed, some British interests, experienced ones at that, looked over the ground and refused to be interested. The truth is that when our own people began to build new plants and repair old ones, we thought they were doing something unusually hazardous. In March, 1915, it looked as if a collapse in the spelter situation, already regarded as preposterous, was imminent. In July it was a common opinion that spelter would be at 6c. by the end of the year. The British are not therefore to be blamed for not going into American zinc smelting, but they ought not to find fault with the American producers.

The British could have played a sure thing at any time—and now for that matter—by revising their military specifications, asking themselves how much high-grade spelter they were buying for purposes wherefor common spelter would suffice, how much common spelter they were using for purposes wherefor cheaper substitutes would be as good, how much refined spelter they have bought instead of buying common and redistilling it themselves. How much galvanized sheet and wire have been bought for temporary use before and behind the trenches? We have heard of galvanized wire being rejected for not coming up to the specifications as to evenness of coating.

The Central Zinc Co., one of the leading smelters of Great Britain, began to make a small addition to its smelting capacity about nine months after the war had begun. Some additions have lately been made by the Welsh smelters, and in the aggregate the spelter production of Great Britain is being increased considerably, but as for the inauguration of any masterful plan for making the country independent, no steps have yet been taken. British capitalists are afraid of the labor question. Are we to wonder at this when we see Lloyd George imploring the unions to relax their rules, the ministry afraid to exercise its munitions act and the allied councils of the unions in conference to determine whether or not they will agree to the policy of the ministry in fundamentals—and all of this when their country is fighting for its life?

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Scarcity of Wolfram in Great Britain

The *Rangoon Times* of Oct. 13, quoted by the London *Mining Journal,* Dec. 4, 1915, comments on the failure of the Indian government to act promptly in the wolfram industry. It observes in part: "A very serious responsibility, concerning wolfram, rests on the Home Government, the government of India, and the government of Burma jointly and severally. The facts are simple enough; there is an urgent need of wolfram at home for the munition factories; Burma possesses this important mineral; yet there is a most unaccountable delay and hesitation in taking steps to increase the present output. The Home Government has, we believe, informed the Indian authorities that it must have wolfram, and

as much of it as possible. It is up to Burma to meet that request."

Patriotism should incite every possessor of a wolfram mine in the British empire to produce all of the ore that he can, but when the government fixed a maximum price of 55s. per unit for a product that was fetching several times as much in neutral markets, there was offered but little incentive. There is nothing like high prices to overcome difficulties of labor scarcity, bad roads, etc. With wolfram ore salable at $2,500 per ton adventurers risked their lives to go into Mexico for it and bring it out on mule-back. The British would have been better off if they had let this matter take care of itself.

The American Institute of Mining Engineers

The board of directors of the American Institute of Mining Engineers is out with a circular respecting the proposed increase of dues on which the members of the institute have been asked to vote by letter ballot. The board says:

The institute is faced with this question, which must be decided as a matter of policy. Shall its activities and growth be restrained to the point necessary to keep within present income? If not, increased income must be provided.

The institute has in recent years provided a handsome return for the dues paid by its members. They have this year received, at cost price, more than they have paid for. If they feel that the present policy of increased service and growth is commendable, they can have it continued only by providing the necessary funds.

The proposed increase is a small one—only $2 per annum—nevertheless a good deal of opposition to it is being expressed. The question is really a very simple one.

In this case there is no controversy over extravagance, poor judgment or anything of that sort. The institute is being run as economically, conscientiously and wisely as can be done. Its chief expense is for the publication of its transactions. The sole question now is whether the members want a maintenance of the present volume of papers at $12 per annum, or would rather have a little less—perhaps more carefully chosen—at $10 per annum.

Pan-American Scientific Congress

The second Pan-American Scientific Congress, held in Washington, concluded on Jan. 8. It was a noteworthy gathering, and it will surely do a great deal to promote better relations among the people of North and South America. The feeling among the diplomats and scientists assembled in Washington was excellent. There was a large attendance of South Americans, but unfortunately only a few belonging to Section VII—the mining and metallurgical section. There was, however, a large attendance from the United States.

In the "final act" of the congress there were but few clauses directly pertaining to the mining and metallurgical industries. These were as follows:

V. That proper steps and measures be taken to bring about in the American republics participating in the congress a general use of the metric system of weights and measures.

XXVIII. (1) That a compilation according to a definite plan be made of the mining laws of the American countries. (2) that the several American governments appoint a committee to consider the uniformity of mining statistics and to make recommendations to their respective governments for the systematizing, simplifying and standardizing of such statistics.

Clause XXVIII originated in Section VII and will command universal approval. Clause V was introduced in another section. Uniformity of weights and measures is highly desirable, but any attempt to substitute the metric system for the existing system in the United States will meet with irresconcilable opposition.

Two or More Electric Blasting Caps per Bore Hole

A method of preventing misfires in large blasts where electric firing is used is discussed in "High Explosives," by the du Pont powder company. It advocates the placing of at least two primers in each hole. If the number of holes to be fired at one shot is nearly as great as the number of caps that the blasting machine will fire, only one of the primers for each hole is connected up, the other being kept in reserve so that in case of a charge missing fire, the second electric blasting cap can be connected up and fired. This may seem at first a rather expensive and extravagant method, but it is much less expensive than having a misfire, which has to be dug out, with the attendant danger and risk, and fired over again. When within the limits of the machine, both blasting caps should be connected up and fired. The additional cost is more than offset by the increased completeness of the detonation of the explosive and the amount of work done.

Where large charges are loaded in each hole, as in sprung holes, it is customary to place one primer in the pocket and one in the bore hole. For bore holes of 5 or 6 in. diameter and 30 to 150 ft. deep, two or more caps should be placed in each hole and all connected up.

The old idea that one detonator was able to explode an indefinite amount of dynamite has been shown to be erroneous. When two electric blasting caps are used, one near the top and one near the bottom of the charge, complete detonation of the entire charge is assured in moderate-sized holes and better work is done than with only one detonator, even when this one explodes all of the dynamite in the hole.

No well-drill holes are fired nowadays with but one electric blasting cap per hole and not many with only two, for not only does the increased efficiency more than pay for the extra caps, but there is too much money value in the explosive in a big well-drill hole, when charged, to risk any chance of a misfire. Three, four and even more electric blasting caps are now frequently used in each charge, and the popularity of this method of blasting is due both to the fact that the explosive is more thoroughly detonated by having several electric blasting caps in it and to the freedom from misfires which goes with this method of loading.

Mining-Law Revision

The Senate, on Jan. 10, passed the Smoot bill for the creation of a commission to revise and codify the mining laws. The matter of mining-law revision is now in the hands of the House of Representatives. Everybody interested in mining—whether in the mines of the West or the offices of the East—is urged to write to the congressman from his district requesting his favorable attention to this important thing. There is nothing else so strongly commands the notice of congressmen.

BY THE WAY

As long as the steamers of the Pacific Mail were running between the East and this country, purchases from this concern had the great advantage that the antimony was imported without restriction, and the reëxportation was possible and induced very large business between this country, Canada and Europe. Owing to the Pacific Mail having withdrawn its service, the antimony is now reaching this country by British and Japanese steamers and before the cargo is taken on a British boat, a guarantee similar to the tin guarantee must be given.

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Engineering and Contracting does not unconditionally guarantee the following dialogue between two workers on the Catskill aqueduct as to deep shafts they had seen: Finally one said: "Aw! you don't know what a deep shaft is. Why, when I was out West I struck a town where they said there was a deep shaft, so I went to look her over. When I got to the location I found the hoist house was made of cut stone and inside it had a marble floor. I went in, and there was the biggest hoist I ever saw running like hell, and the hoist runner was sitting in a chair sound asleep. I ran over and woke him up, and I says 'You will be pulling the skip through the head house if you don't stop her.' He says, 'What day of the week is it?' and I says, 'Tuesday.' 'Oh, hell!' he says, 'she won't be up till Friday.' That's what I call a deep shaft."

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The laborers in the metallurgical works in the vicinity of Youngstown, Ohio, demanded an increase of pay from 19½ to 25c. per hr., but being given only 22c., they were dissatisfied, struck, exhibited a disposition toward turbulence, and on Jan. 7—under the influence of John Barleycorn—engaged in a riot wherein several men were killed, more were wounded, and the town of East Youngstown was burned flat. During the last operation the shops of the merchants were looted without restraint, whisky barrels from the saloons contributing toward the orgy. The loss of property is estimated at $1,500,000, and the fire-insurance companies are not responsible The local police were powerless to protect it, and three regiments of state troops arrived too late. This was a new and startling episode of labor warfare. The idea appears to be that if the capitalists will not come across and are able to protect their own property, attention may be turned to robbing the shopkeepers. This is hard on the shopkeepers.

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"Probably one of the luckiest men in Bridgeport," says the *Wall Street Journal*, "at the present time is a manufacturer of special steels requiring tungsten. He has three tons of this precious alloy (*sic*) on hand, which he bought during the early part of the war in small amounts. The average cost is less than $1.50 per lb., and at these prices he has a profit of $8.50 per lb., or a total of about $50,000. This manufacturer takes orders for tungsten-bearing steel and sends the amount of tungsten required to the mill taking his order. The tungsten is kept by him in a steel vault guarded by a watchman night and day. If an order requires that 100 lb. of tungsten be sent to a certain mill, that amount is carefully weighed and expressed. When the order is filled, this man analyzes the steel to see that the required amount of tungsten was used, and if the analysis falls below the required standard, an accounting is asked from the steel maker. He has been attempting to procure additions to his hoard for several months, but thus far has been unable to purchase any." It is true that one of our friends told us last week that he had bought a thousand pounds at $6.50 per lb., which isn't $8.50 above $1.50, but perhaps the foregoing item is correct.

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"You of 'By the Way' have not had a monoply of Eureka, and I think it is unfair to make sport of the railway," writes a correspondent. "I used to have to make the trip from Palisade to Mineral Hill, and I know that that railroad has difficulties that others do not. There are several places along the right-of-way where the ground is so uneven that the grades are heavy. There was no possible way of avoiding this except to make cuts and fills. One of these grades begins (unfortunately for the railway company and the fireman and the conductor) just in front of a farm belonging to Otto Schmidt, and I understand that the company is at deadlock with Otto as well. In any case, I never passed there on the trip out that Otto didn't 'sic' his dogs onto the train. Naturally all the passengers were interested in the result of the race, and if the fireman had been neglectful or if the load of passengers was greater than usual, it was exciting. The conductor would stand on the rear platform with a cane or an umbrella and try to frighten the dogs off, but there was one big Dane that was most successful in catching the air hose. If he once set his teeth in it, it meant that we had to back down grade and get a new start, while the dogs ate the bait meat the conductor always had along for such emergencies."

⁂

A news dispatch from Bridgeport, Conn., describes a little farm called "Toadhurst," where it is said that 1,500 educated toads play an important part in the daily routine, being arranged in regular drill formation. This tale bears a faint resemblance to an anecdote related by an old prospector of the "'tropical-tramp" genus. "Wanst we was workin' at the Estrella de Oro mine down in the jungles av Peru, thryin' to instal a flotayshun plant. Petrolyum bein' expensive, we had to use cocoanut ile to mix with the ore. We only worked the little mill in the daytime, makin' about half a ton av concentrates each day for a week; but ivery mornin' the concentrate bin was empty. Divil a futprint av the thieves cud we find, at all, at all. The next week bein' mostly fiestas, we jist crushed all the ore on hand down to 40-mesh an' left it in the upper bin. Whin the holidays was over we found a pile av tailin's on wan side av the bin, but the sulphides was plumb missin'. After full investigayshun we found that the high-graders was a big band av these here leaf-cuttin' ants. They had started in takin' the concentrates on account av the cocoanut-ile flavor, an' whin the concentrate bin was empty they jist nacherally tackled the raw ore an' picked out the values on suspishun. We saw wonderful possybilities in catchin' thim ants an' eddycatin' thim to do all the mill work. But whin we finally tracked thim to their nests we found that ivery blame wan av thim had worn out his jaws thryin' to crack the raw ore to get the ile they expected to find inside."

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AGGLOMERATING—Machine for Agglomerating Ores. Philip O. Harding, Pittsburgh, Penn. (U. S. No. 1,166,904; Jan. 4, 1916.)

AGGLOMERATING — Method of Agglomerating Ores. Philip O. Harding, Pittsburgh, Penn. (U. S. No. 1,166,903; Jan. 4, 1916.)

ALLOY of Iron. Herbert E. Field and Fred Clinton Tilton Daniels, Wheeling, W. Va. (U. S. No. 1,166,342; Dec. 28, 1915.)

ALUMINUM—Process of Coating Iron with Aluminum. Sadamasa Uyeno, Tokyo, Japan. (U. S. No. 1,165,920; Dec. 28, 1915.)

BLAST FURNACE—Flue Structure for Hot-Blast Stoves. Julian Kennedy, Pittsburgh, Penn. (U. S. No. 1,167,081; Jan. 4, 1916.)

BLAST-FURNACE BELL. James M. Cosper, Bessemer, Ala. (U. S. No. 1,164,929; Dec. 21, 1915.)

BLASTING—Process of Preparing Holes for Blasting. William H. Mason, Easton, Penn. (U. S. No. 1,165,694; Dec. 28, 1915.)

BLOWER—Turbine Blower. William McClave, Scranton, Penn., assignor to McClave-Brooks Co., Scranton, Penn. (U. S. Nos. 1,165,794 and 1,165,795; Dec. 28, 1915.)

BLOWER—Steam-Turbine Blower. William McClave, Scranton, Penn., assignor to McClave-Brooks Co., Scranton, Penn. (U. S. No. 1,165,796; Dec. 28, 1915.)

CALCINING, DESULPHURIZING, and Agglomerating Ores, Etc. Franz Meyer, Englewood, N. J., assignor to Dwight & Lloyd Metallurgical Co., New York, N. Y. (U. S. No. 1,166,142; Dec. 28, 1915.)

CANDLESTICK—Miner's Candlestick. Johan Hansen, Tonopah, Nev. (U. S. No. 1,163,912; Dec. 14, 1915.)

CHARGING-CAR FRAME. Charles F. Frede, St. Louis, Mo., asignor to Commonwealth Steel Co., St. Louis, Mo. (U. S. No. 1,165,959; Dec. 28, 1915.)

COBALT—Process for Separating Cobalt from Ores or Byproducts. Philip M. McKenna, Washington, D. C., assignor to Chemical Products Co., Washington, D. C. (U. S. No. 1,166,067; Dec. 28, 1915.)

COKE—Apparatus for the Manufacture of Coke. John Armstrong, London, England. (U. S. No. 1,166,422; Jan. 4, 1915.)

COKE—Continuous-Process Coke Oven. James A. Bishop, Mascoutah, Ill. (U. S. No. 1,166,175; Dec. 28, 1915.)

CONCENTRATION—Ore-Concentrating Apparatus. Thomas A. Janney, Garfield, Utah. (U. S. No. 1,167,076; Jan. 4, 1916.)

CONVEYOR SYSTEM for Ashes. William McClave, Scranton, Penn., assignor to McClave-Brooks Co., Scranton, Penn. (U. S. No. 1,165,791; Dec. 28, 1915.)

CRUSHER. Robert Linn, Chicago, Ill., assignor of one-fourth to Fred C. Edler and one-fourth to Jacob Alter, Chicago, Ill. (U. S. No. 1,166,403; Dec. 28, 1915.)

CRUSHER—Rock Crusher. Charles G. Simonds and Albert E. Smith, Milwaukee, Wis. (U. S. No. 1,164,762; Dec. 21, 1915.)

CRUSHING—Bearing for Rolls of Crushing Mills. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,164,672; Dec. 21, 1915.)

CYANIDING—Apparatus for the Recovery of Precious Metals. Bruno R. Koering, Detroit, Mich., assignor to Koering Cyaniding Process Co., Detroit, Mich. (U. S. No. 1,163,828; Dec. 14, 1915.)

DREDGING—Operating Means for Dredging Buckets. Arthur Nathan Doud, Cleveland, Ohio, assignor to Lakewood Engineering Co., Cleveland, Ohio. (U. S. No. 1,164,076; Dec. 14, 1915.)

DRILL—Rock Drill. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,164,496; Dec. 14, 1915.)

DRILL-BIT RETAINING DEVICE. Rudolph S. Weiner, El Paso, Tex., assignor to Sullivan Machinery Co., Claremont, N. H. (U. S. No. 1,164,560; Dec. 14, 1915.)

DRILLING—Improvements In or Connected with Rock-Drilling Machines. W. C. Stephens, Cornwall, England. (Brit. No. 1,484 of 1915.)

DRYING—Ore-Drying Apparatus. John Q. A. Houghton, Lowell, Vt. (U. S. No. 1,166,909; Jan. 4, 1916.)

DUMPING-BUCKET AND HOISTING MECHANISM THEREFOR. Franklin E. Arndt, Galion, Ohio, assignor to The Galion Iron Works and Manufacturing Co., Galion, Ohio. (U. S. No. 1,166,035; Dec. 28, 1915.)

DUST—Process of Recovering Flue Dust. Samuel W. Osgood, Chicago, Ill., assignor of one-half to A. J. Jewell, Chicago, Ill. (U. S. No. 1,166,927; Jan. 4, 1916.)

ELECTRIC FURNACE. Frederick T. Snyder, Oak Park, Ill. (U. S. No. 1,167,026; Jan. 4, 1916.)

ELECTROLYSIS (Zinc). Clarence A. Hall, Mount Airy, Penn. (U. S. No. 1,163,911; Dec. 14, 1915.)

EXCAVATING MACHINE. Matthew Arnold, Butte, Mont., assignor of one-half to Louis E. Haven, Butte, Mont. (U. S. No. 1,164,448; Dec. 14, 1915.)

EXCAVATION—Self-Filling and Cleaning Scraper or Excavation Bucket. Hermann Kendle, Eatonville, Wash. (U. S. No. 1,166,601; Jan. 4, 1916.)

EXCAVATOR—Drag-Line-Bucket Excavator. Morton G. Bunnell, Chicago, Ill., assignor to Frederick C. Austin, Chicago, Ill. U. S. No. 1,167,146; Jan 4, 1916.)

FILTER. Charles Butters, Oakland, Calif. (U. S. No. 1,165,068; Dec. 21, 1915.)

FIRE BRICK. Henry Tanner, Chicago, Ill. (U. S. No. 1,164,680; Dec. 21, 1915.)

FURNACE. Horace E. Smythe, Pittsburgh, Penn., assignor to The S. R. Smythe Co., Pittsburgh, Penn. (U. S. No. 1,165,725; Dec. 28, 1915.)

FURNACE. William N. Best, New York, N. Y. (U. S. No. 1,166,807; Jan. 4, 1916.)

FURNACE-DUST COLLECTOR. Utley Wedge, Ardmore, Penn. (U. S. No. 1,165,351; Dec. 21, 1915.)

FURNACE for Melting Metals. Edwin Bosshardt, Emmenbrücke, near Lucerne, Switzerland. (U. S. No. 1,164,983; Dec. 21, 1915.)

FURNACE GRATE—Nonsifting Grate for Furnaces. William McClave, Scranton, Penn., assignor to McClave-Brooks Co., Scranton, Penn. (U. S. No. 1,165,793; Dec. 28, 1915.)

FURNACE LINING—Refractory Lining. Tor A. R. W. Torsen, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,167,135; Jan. 4, 1916.)

GOLD ALLOY. Karl Gustav Paul Richter, Pforzheim, Germany, assignor to the Firm of Dr. Richter & Co., Pforzheim, Germany. (U. S. No. 1,165,448; Dec. 28, 1915.)

GOLD-EXTRACTION MACHINE. Charles Suiter, Billings, Mont. (U. S. Nos. 1,164,676 and 1,164,677; Dec. 21, 1915.)

HOIST—Continuous Mine Hoist. Edward O'Toole, Gary, W. Va. (U. S. No. 1,165,017; Dec. 21, 1915.)

HOISTING BUCKET. George E. Cook, New York, N. Y., assignor, by mesne assignments, to Union Iron Works, Hoboken, N. J. (U. S. 1,166,400; Dec. 28, 1915.)

INSULATING MATERIAL. John Ferla, New York, N. Y., assignor to American Mineral Wood Manufacturing Co. (U. S. No. 1,165,164; Dec. 21, 1915.)

IRON-ORE REDUCTION—Process of Reducing Iron Ores and Other Metallic Oxides to the Metallic State. Emil Bruce Pratt, Lakewood, Ohio. (U. S. No. 1,167,016; Jan. 4, 1916.)

LAMP—Acetylene Lamp. Augie L. Hansen, Evanston, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,165,969; Dec. 28, 1915.)

LEAD—Apparatus for the Dissolution of Lead Ores. Samuel W. Anderson, Spokane, Wash. (U. S. No. 1,165,742; Dec. 28, 1915.)

MINE-CAR WHEEL. John Coan, Baldwin, Colo. (U. S. No. 1,164,470; Dec. 14, 1915.)

NITRIC ACIDS—Improvements in the Concentration of Nitric Acids. Norsk Hydro Elektrisk Kvaelstofaktiesclskab, Christiana, Norway. (Brit. No. 19,792 of 1914.)

ORE TREATMENT—Apparatus for Treating Ores and Other Materials. Henry B. Hovland, Duluth, Minn. (U. S. Nos. 1,164,188 and 1,164,189; Dec. 14, 1915.)

ORE TREATMENT—Apparatus for Treating Ores and Other Materials Under Pressure. Henry B. Hovland, Duluth, Minn. (U. S. No. 1,164,187; Dec. 14, 1915.)

PEAT—Utilization of Peat. Nils Testrup, London, England; Thomas Rigby, Dumfries, Scotland, and Olof Söderlund, London, England, assignors to Wetcarbonizing Ltd., London, England. (U. S. No. 1,164,429; Dec. 14, 1915.)

PYRITE—Treatment of Pyrite or Other Iron Sulphides. Lewis Trompson Wright, London, England. (U. S. No. 1,164,049; Dec. 14, 1915.)

ROASTING—Ore Furnace. Lewis Bailey Skinner, Denver, Colo. (U. S. Nos. 1,164,131 and 1,164,132; Dec. 14, 1915.)

ROASTING—Stirrer for Roasting Furnaces. Lewis Bailey Skinner, Denver, Colo. (U. S. No. 1,164,130; Dec. 14, 1915.)

SEPARATION—Apparatus for Separating or Classifying Ores. Herbert E. Wetherbee, Cleveland, Ohio, assignor to Wetherbee Concentrator Co., Cleveland, Ohio. (U. S. No. 1,163,876; Dec. 14, 1915.)

SEPARATION—Apparatus for Separating Solids from Liquids. Herbert E. Wetherbee, Cleveland, Ohio, assignor of one-half to Richard F. Grant, Cleveland, Ohio. (U. S. No. 1,163,875; Dec. 14, 1915.)

SHOVEL—Power Shovel. Edwin J. Armstrong, Erie, Penn., assignor to Ball Engine Co., Erie, Penn. (U. S. Nos. 1,163,633 and 1,163,634; Dec. 14, 1915.)

SLAG—Apparatus for Utilizing Heat from Hot Slag. William H. Daily, Tucson. (U. S. No. 1,166,745; Jan. 4, 1916.)

SMELTING FURNACE. Charles K. Davis, Detroit, Mich. (U. S. No. 1,165,393; Dec. 28, 1915.)

SMELTING—Process for Smelting Metallic Ores. Otto Baltin, Lipine, Germany. (U. S. No. 1,166,171; Dec. 28, 1915.)

SMELTING—Process of Smelting Ores. John H. Klepinger, Milo W. Krejci and Charles R. Kuzell, Great Falls, Mont. (U. S. No. 1,164,653; Dec. 21, 1915.)

STOKING MECHANISM FOR FURNACES. William McClave, Scranton, Penn., assignor to McClave-Brooks Co., Scranton, Penn. (U. S. No. 1,165,792; Dec. 28, 1915.)

TIMBER—Preservative Treatment of Timber. William Dennison Clark, Portland, Ore. (U. S. No. 1,165,753; Dec. 28, 1915.)

TIMBER-TREATING APPARATUS. John H. Grow, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,164,938; Dec. 21, 1915.)

TIN—Process for the Production of Tin-Iron Matte from Pyritic or Other Tin-Ore Concentrates, Tin Waste, Tin-Plate Waste, Stanniferous Slag and the Like. Jan Reub, The Hague, Holland. (Brit. No. 20,609, of 1914.)

TUBE MILLS—Method of Grinding in Tube Mills. Meyer Joseph Davidsen, Paris, France. (U. S. No. 1,164,264; Dec. 14, 1915.)

TUNNELING MACHINE. Dighton A. Robinson, Seattle, Wash. (U. S. No. 1,163,859; Dec. 14, 1915.)

WEIGHER—Duplex Weigher. Edwin H. Messiter, Brooklyn, N. Y., assignor to Electric Weighing Co., New York, N. Y. (U. S. No. 1,163,678; Dec. 14, 1915.)

PERSONALS

F. R. Weekes has returned to New York from California.

Leo Von Rosenberg, of New York, has been in southern Arizona.

R. B. Lamb has returned from Cobalt, Ont., and has gone to Oatman, Ariz.

Robert E. Cranston, of San Francisco, is at Butte, Mont., on professional business.

George E. Hayes, mining engineer and geologist, recently of Burke, Idaho, is now at Greybull, Wyoming.

Julius Cohen has been placed in charge of the Croesus gold mine, Munro Township, in northern Ontario.

W. deL. Benedict has returned to New York after an absence of three months in California and the West.

H. S. Mulliken has been appointed manager of the mines and smelter of the Peñoles Co., at Mapimi, Durango, Mexico.

Blamey Stevens, manager of the Lane-Rincon Mines, Temascaltepec, Mexico, is in New York to report to his company.

George H. Garrey has returned to New York from Seattle and Vancouver after four or five months spent in various mining camps of the West.

T. L. Hughes has been appointed district manager of the Lehigh Portland Cement Co. at New Castle, Penn., in place of P. A. Jandernal, resigned.

William A. Burr will be in New York in January and will open an office there. He will also reopen his offices at Parral, Mexico, and in Mexico City in the near future.

Neil Morrison, of Elk Lake, has been appointed superintendent and W. C. Baycroft, formerly of Sudbury, engineer and assayer of the Reeves-Dobie mine, Gowganda, Ontario.

Col. John Carson, of Montreal, president of the Crown Reserve Mining Co. and now on active service abroad, has received from King George the title of Civil Commander of the Bath.

Alexander P. Rogers sailed from New York on Dec. 26 for South America where he will be engaged in professional work for several months. His address will be care of W. R. Grace & Co., Oruro, Bolivia.

Prof. Roswell H. Johnson, of the University of Pittsburgh, attended the Second Pan-American Scientific Congress at Washington. On Dec. 29 he read a paper before the congress upon the "Conservation of Oil and Gas."

Emil Baerwald, of New York, announces that the American business of Messrs. Lewis Lazarus & Sons, of London, will, from Jan. 1, 1916, be conducted under their own name, the management remaining in his hands as heretofore.

D. E. Woodbridge and W. G. Swart, mining engineers, are establishing an experimental laboratory in West Duluth, Minn., to endeavor to perfect a process for separating the good rock from the waste in mine refuse, eliminating an annual loss to the mining companies of many thousands of dollars.

Chas. E. van Barneveld, chief of the Department of Mines and Metallurgy of the Panama-Pacific International Exposition, is visiting Washington and New York and will return to Berkeley, Calif., to take up his work as professor of mining at the College of Mines, University of California.

At a recent meeting of the board of managers of the Lehigh Coal and Navigation Co., the administration of the commercial operations of the company was assigned to H. F. Baker, vice president, effective Jan. 1, 1916. Henry H. Pease, treasurer, was also elected secretary, vice Mr. Baker, resigned.

Henry B. Hovland, a director of the Inspiration Consolidated Copper Co., has taken out letters patent on methods for concentrating oxide and carbonate ores by sulphiding them. The patent is the result of several years' experimentation, and details of the process have not yet been given out.

R. W. Schultz has resigned his position as mill superintendent of the Mond Nickel Co., Ltd., Coniston, Ont., as his extensive experimental work, covering a period of nearly two years, on the concentration of the low-grade copper-nickel ores of the Sudbury district by both gravity and flotation, has been successfully completed. He is enjoying a rest at his home in Ravenna, Ohio.

Dr. Charles S. Palmer, formerly professor of chemistry in the University of Colorado, for several years an associate editor of the "Engineering and Mining Journal," and later consulting chemical engineer for various manufacturing interests in New England, has recently accepted a fellowship in the Mellon Institute for Industrial Research of the University of Pittsburgh.

Hugh M. Wolfiin, in charge of the United States Bureau of Mines' mine-rescue station on the Pacific Coast, is to be transferred from San Francisco to the Bureau's chief station at Pittsburgh. Edwin Higgins, also of the Bureau's staff, has been selected to succeed Mr. Wolfiin as engineer to the California Industrial Accident Commission, without, however, severing his official connection with the bureau.

Norman C. Stines, mining engineer and graduate of the University of California, returned to California from Siberia in the latter part of December. Mr. Stines is manager of the Sissert estate of 440,000 acres in Perm district, owned by the English-Russian Corporation and managed from Petrograd. He is in America for the purpose of buying mining supplies and spent the holiday weeks with his parents, Mr. and Mrs. Charles Preble, of Berkeley.

The following changes at the works of the Anaconda Copper Mining Co. are announced: R. E. Howe, formerly chief chemist, has been promoted to be assistant superintendent of the converter department. Pierce Barker, formerly assistant chief chemist, has been promoted to be chief chemist. R. B. Caples, formerly assistant testing engineer, has been promoted to be assistant chief chemist. J. Root has been promoted to be assistant testing engineer.

Dr. Frederick J. V. Skiff and Mrs. Skiff left San Francisco Dec. 27 for the East. Doctor Skiff was director-general of the Panama-Pacific Exposition and was steadily engaged at his duties in San Francisco for the past year. Prior to undertaking personal direction of the Exposition, Doctor Skiff traveled extensively in foreign countries on behalf of the Fair. The success of the enterprise was very largely due to his experience in other similar enterprises.

John D. Pope, for more than 10 years general manager of the North Butte Mining Co., has resigned to take a long-needed rest and to devote his attention hereafter to private affairs. Thomas F. Cole, who has recently been in Butte to inspect the company's properties, announced that the change in management would not involve a change in company's policy, that no new work at the company's outlying properties was contemplated for the present and that the company's activities would be confined to the operation of its producing mines for some time to come.

Frank M. Leland, who has made a great success in rebuilding the fortunes of the Empire Copper Co. at Mackay, Idaho, has retired from the management of its properties, control of the company having been acquired recently by L. R. Eccles and associates, of Salt Lake City and Ogden. Ralph R. Osborn will continue as general manager, while Mr. Leland will retain a connection with the company as consulting engineer. However, the major part of his time and attention will be devoted hereafter to the affairs of the Balaklala company of California, of which he is general manager.

Louis A. Wright, who has been mining engineer for the General Development Co. for many years, recently severed his connection with that company and joined the staff of the American Metal Co., for which company he is to serve in Chile. Mr. Wright, accompanied by his family, sailed for Chile on Jan. 8, with the expectation of not returning to this country inside of two years. A few days before leaving a group of his friends tendered him a farewell dinner, at which many of his old associates of the General Development Co. were present. On that occasion Adolph Lewisohn, president of the General Development Co., presented him with a mammoth loving cup in behalf of his old associates, in whose esteem he stood so highly.

OBITUARY

Mine Captain McFarlane, of the Cobalt-Comet mine, Cobalt, Ont., was killed and A. Macdonald had his feet badly injured on Dec. 20 by a blast from a hole which failed to explode with the others and which they supposed had gone off.

Joseph Bennett Dyer died at Oakland, Calif., Dec. 17. He was 57 years old and was born in San Francisco. Mr. Dyer was well known in Alaska as one of the pioneers of 22 years ago who went into the interior and discovered gold. He had spent a great deal of time in Alaska since then and returned to Oakland to remain permanently two years ago.

Robert V. Clark, one of the first men to go into Eldorado County in 1848, at the time of Marshall's discovery of gold at Coloma, died on Dec. 15 at Coloma, Calif., where he had resided since going into the state when a boy of 13. He was

a native of Indiana and 69 years old. He spent the earlier days in mining, but in the latter part of his life engaged in farming.

Charles C. Scaife, president of the William B. Scaife & Sons Co., died in Pittsburgh, Penn., Dec. 30, aged 71 years. He was born and brought up in Pittsburgh, and after serving in the Civil War he entered the business established by his grandfather, in which he remained 50 years. Since the death of his father in 1876 he had been the active head of the concern. He leaves a widow, two sons and a daughter.

William H. Holmes, a pioneer engineer, died Dec. 17 in the Federal Soldiers' Home at Monte Vista, Colo., at the age of 74 years. He was a member of the famous Hayden Survey and had been interested in Colorado's mining growth since those early days. He participated in the survey of the first Santa Fe railroad line into the state. At one time he was government inspector of surveys. Geology was a subject in which he took great interest.

George I. Ives died at San Francisco on Dec. 27, from heart trouble. Mr. Ives was one of the oldest members of the Stock Exchange, of which he was at one time president. He was a charter member of the Pacific Union Club and a Mason of high degree. He was born in New York City and went to San Francisco when a boy of 15, making the trip through the Straits of Magellan. For several years he was interested in mining at Nevada City and for a period occupied a responsible position at the United States Mint in San Francisco.

Charles Francis Hendrie, original partner in the mining machinery firm of the Hendrie & Bolthoff Manufacturing and Supply Co., died at his home, Denver, Colo., Dec. 22, at the age of 76 years. For the past 15 years he had been retired from active business, being succeeded as president of the firm by his brother, Edward B. Hendrie. The immediate cause of his death was pneumonia. Mr. Hendrie first went to Colorado from Burlington, Iowa, in 1864, and opened a machinery and supply store at Central City. He did not remain more than a year or so, as his parents were insistent that he become an Episcopalian clergyman, and he returned to the states to study. However, poor health required him to give up this calling and, in 1868, he again settled in Central City with his wife whom he had taken two years previously. Ten years later he moved his business to Denver and formed a partnership with W. H. Bolthoff, a firm that, with only small change in title, has continued to date.

SOCIETIES

National Foreign Trade Convention—The third meeting will be held at New Orleans, La., Jan. 27-29. A large number of invitations have been issued, and it is expected that the convention will be a representative gathering.

American Institute of Mining Engineers—The next meeting of the New York Section will be held Jan. 19 at the Machinery Club, 50 Church St. The meeting will be preceded by a dinner served at 6:30. Following the dinner the subject of "The Problems of the Naval Consulting Board" will be discussed by W. L. Saunders, Commander H. B. Frye and Dr. L. H. Baekland, all members of the Naval Consulting Board.

Chamber of Mines and Oil—At the recent annual meeting at Los Angeles, Calif., the following officers were chosen: President, Theodore Martin; first vice president, Thomas Thorkildsen; second vice president, Dr. Norman Bridge; directors, J. O. Royer, S. F. Forbes, Edgar Baruch, Alvin B. Carpenter, Edward G. Judah, Eugene H. Law, Samuel E. Yount, J. Nelson Nevius, Seeley W. Mudd, Chas. B. Barnes, Thos. A. O'Donnell, L. P. St. Clair, C. Colcock Jones, D. F. McGarry, H. P. Anewalt.

American Society of Mechanical Engineers—At a meeting of the New York Section, Jan. 11, Walter N. Palakov, superintendent of power of the New York, New Haven & Hartford R.R., discussed the question of standardization and predetermination of the cost of power. He demonstrated a simple method by which the owner of a power plant of any kind can, without the necessity of study of technical details, determine just how close the cost of his own plant is to the possible minimum cost of such a plant—in other words, how much more he is paying for power than he should pay. An open discussion followed.

Colorado School of Mines—The success that attended the first Prospector's Course, held in January and February, 1915, has induced the school to offer an enlarged course during the coming winter. The course in 1915 occupied three weeks; the course now offered will occupy five weeks, from Jan. 31 to Mar. 4, 1916. The study of prospecting geology, including common minerals and rocks, will be extended to 50 hr. There will be a 30-hr. course in chemistry. A special laboratory for prospectors is now being fitted up and equipped. A 5-hr. course will be given in the elements of metallurgy. The new flotation machines that have been installed will enable the student to avail himself of opportunities in this direction. A special course in assaying is offered, actual supplies consumed to be paid for by the student. The mining department will offer a 5-hr. course in placer mining, a 10-hr. course in lode mining and a 10-hr. course in mining claims. Particular attention will be given to the laws governing the location of claims, mill and tunnel sites, water rights, etc. A new course in first-aid-to-the-injured and mine rescue work will be given by the department of safety engineering.

INDUSTRIAL NEWS

H. W. Caldwell & Sons, of Chicago, has opened a new office at 711 Main St., Dallas, Tex., in charge of S. C. Van Arsdell.

The Art Metal Works, 7-15 Mulberry St., Newark, N. J., is desirous of securing the name of some manufacturer of metallic calcium, barium or strontium.

The Hammond Iron Works, of Warren, Penn., having offices in New York and Tulsa, on Jan. 1 opened a sales office in Los Angeles, Calif., with G. C. Hoyt, Pacific Coast representative, in charge.

The Raymond Granite Co., of San Francisco, has been awarded the contract for furnishing the granite for Benjamin Ide Wheeler Hall at the University of California. Contract price, $225,000.

The Pacific Rolling Mill Co., San Francisco, has been awarded the contract for the structural steel to be used in building an addition to the library of the University of California. Amount of contract, $46,232.

The Richardson-Phenix Co., lubrication engineers and manufacturers, Milwaukee, Wis., has recently opened a branch office in Boston, Mass., situated at 141 Milk St., and announces the removal of its New York office to 30 East 42nd St.

A series of three industrial motion-picture films, illustrating the manufacture of "National" pipe, from ore to finished product, was shown before the students of the Department of Metallurgy, Lehigh University, South Bethlehem, Penn., on Jan. 7, 1916.

Control of the magnesite deposits on the Island of Margarita, off the coast of Venezuela, in the Caribbean Sea, has been acquired by the Magnesite Products Corporation, Ltd. The corporation proposes to start business at once. The engineer is C. F. Z. Caracristi.

The construction of a cement factory in San Joaquin Valley, California, is contemplated by Fresno men who are interested in lime deposits. A large amount of cement is used by farmers and by miners in small quantities, and it is this class of consumers that the enterprise will seek to supply.

The partnership of Myers & Whaley, consulting civil, mining and mechanical engineers, Knoxville, Tenn., which has existed for over nine years, has been dissolved. R. V. Myers continues his office as civil and mining engineer, 1220 Holston Bank Building, Knoxville, Tenn., and William Whaley will devote his time to the affairs of the Myers-Whaley Co., building shoveling machines under the Whaley patents.

The organization of the Electric Steel Co. marks a new development in the steel-castings industry of Chicago. At the present time the only electric furnace in Chicago is of the Heroult type and melts steel for large castings. The other jobbing steel foundries all operate converters. The Electric Steel Co. will operate an electric furnace and will confine itself to small castings of superior quality, especially in alloy-steel castings. In order to commence operation with the least possible delay and to offer quick delivery, the company has leased a plant at 31st and Wood St.

The C. C. & E. P. Townsend Co. announces that the name of the corporation was changed on Jan. 1, 1916, to the Townsend Co. The officers are: R. T. Townsend, president and general manager; J. M. Townsend, vice president; V. L. Bradford, secretary and treasurer. The main office and mills are at New Brighton, Penn. With the arrival of the year 1916 the company completes a "Century of Business" as manufacturers of rivets, nails, wire and wire products, and in the celebration of this centennial they take occasion as the Oldest Wire Mill in America to thank their many friends for the patronage with which they have been favored.

Editorial Correspondence

SAN FRANCISCO—Jan. 5

The State Mining Bureau is starting out the New Year with the distribution of five parts of the biennial report. These chapters include the Counties of Amador, Calaveras, Tuolumne, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Shasta, Siskiyou, Trinity, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino. This plan of issuing the reports of the several counties in groups as fast as the field work and compilation are completed, render the reports more valuable because of being nearer up to the date of publication and distribution. Beside this, the separate books or chapters are much more convenient for the library and desk than the bulky form necessitated by including all the counties in one publication.

Comstock Mines Made a Handsome showing in the last days of the year. For a few months past the average value of the ores extracted from the Northend mines has been increasing and the amount of ore extracted in the last half of December also shows an increase. In the week ended Dec. 25, Union extracted 347 tons of ore having a gross value of approximately $10,000. This ore was taken from four points in the mine, on the 2,400 and 2,500 levels. The averages per ton were $9.45, $14.61, $18.91, $51.55. Of the total tonnage extracted 129 tons was of the high-grade ore. Sierra Nevada shipped to the mill 145 tons having a gross value of $2,023. The Mexican mill reported a good run for the week, handling 493 tons of custom ore of an average value of $23.83. The prosperity of the Northend also extends to Gold Hill. Crown Point-Belcher extracted 324 tons of mill rock and the Jacket mill received 801 tons of dump rock and 202 tons of mine rock. So that the Christmas-day news that comes from the Comstock Lode is in keeping with the spirit of the times and provides an element of encouragement to the operators and the stockholders.

Extraordinary Rain and Snow Storms ushered in the New Year in California. Beside the heavy fall of snow in the Sierra and the foothills, the snow reached the lower elevations of the western slope and extended also to a number of valley towns where snow is seldom seen. Marysville, which is the chief town in the Yuba basin dredging district, at an elevation of only 66 ft. above sea level, had 5 in. of snow. Stockton, one of the chief river towns of the state, which has not been visited by snow for 33 years, received enough on New Year's day to give everybody a sleigh ride, who had the time and the means to construct a sled. Fresno the center of the great grape-growing district of southern California had its first snowfall in five years; it measured 4 in. Sacramento and the floor of the Sacramento Valley had enough snow to cover the ground for several hours. Even Berkeley, the home of the University of California, had its first snow since 1912. The snow storm prior to that was in 1907. Rain followed the snow on Sunday, Monday and Tuesday and was reported to have reached into the higher hills and mountain ranges. Snow in the higher mountains and rain in the valleys are assurance of abundant water for both mining and agricultural purposes unless the rain continues in the higher elevations for too long a period. Wind accompanied the first rain, starting in Santa Barbara County and sweeping the entire coast north and into Oregon. Large amount of damage was done to buildings and several persons were badly injured. Two deaths in Oakland and one in San Francisco were reported. Sacramento River rose 10 ft. and other streams reported running high; but no damage by overflow has been reported.

The Mariposa Estate, commonly called the Fremont Grant, situated in Mariposa County at the southerly end of the Mother Lode, is to be acquired by the Ralston Development Co. This has been incorporated, with $3,000,000 capitalization, by W. C. Ralston, ex-Governor J. N. Gillett and F. J. Solinsky, all of San Francisco. The company will also have offices in New York. While California was under the dominion of Mexico in 1847, the grant was purchased by John C. Fremont. He presented his claim to the United States and the patent was issued in February, 1856. The Mexicans mined here in the early days and were followed by the pioneer Americans. The gold-bearing ore was usually found in pockets, some of them being exceedingly rich, varying in amounts from $100 to $30,000. The quartz veins were worked on a more extensive scale in later years and the grant is reported to have produced about $12,000,000 from 70 separate veins. The property has been in litigation a good deal of the time and a suit was recently started in the Superior Court at Oakland by W. G. Langan for $1,500,000 against the Mariposa Commercial and Mining Co., involving title to the Mount Bullion mine, the Mariposa mine and the townsite of Mt. Ophir. The action rests upon the alleged failure of the defendant to sell the property after first payment had been made. The purchase agreement was made by William H. Cook and Walter Parker and $5,000 paid on the purchase price of $1,000,000. Cook and Parker assigned their claim to Langan. With the settling of litigation and the adoption of modern methods of development and operation, this great property containing nearly 50,000 acres should become one of the large producing mines of California. It has been favorably reported, it is said, by J. Ross Browne, W. T. Bourne, Rossiter W. Raymond and other men in high standing. The property is too large to be operated on any other than an extensive scale and by men acquainted with the Mother Lode. The litigation undoubtedly will be settled, so that title to the entire property may be quieted and the promoters of the enterprise permitted to proceed with development that will add another great producer to the Mother Lode mines.

Mining Progress in Eldorado County has in the past year become notable particularly in respect to development of two important mines, one quartz, the other gravel. The Plymouth Exploration Co. of Amador County composed of, or subsidiary to, Bewick-Moreing interests, is sinking a 1,200-ft. double-compartment shaft on the Montezuma mine at Nashville. The shaft is progressing at the rate of 80 ft. a month and is now down 500 ft. This is one of the old producing mines which is being prepared for new development and exploration on the same scale and by the same methods as were employed at the Plymouth mine in Amador County. The Rising Hope is a deep-channel gravel mine which has been developed, equipped and put in the producing class within the last five years. The interesting feature of this work is that it was undertaken and carried through by George W. Englehardt, an Eastern man who had never seen and knew nothing whatever about a mine until he took hold of this property. He was assisted financially by two New York bankers and employed as assistants and advisors engineers of well known ability and reputation, Charles M. Hensen as mine superintendent and George O. Perry as mill superintendent. They have developed and equipped one of the best gravel mines in the county if not in the state. Besides the main tunnel in the bed of the channel, crosscuts, drifts, winzes, and raises have been made, aggregating a total of 10,000 lin. ft. The body of pay gravel in the main channel is 150 to 300 ft. wide and 3 to 20 ft. deep. The gravel shows an assay value from $1.65 to $12.10 per ton and in some portions of the bench it runs from $20 to $50 to the car. The property is equipped with a revolving-barrel gravel mill which handles an average of 6 tons of gravel per hour. This single unit is to be duplicated and the milling capacity afterward increased according to the requirements. The mill is driven by water power through a 3-ft. impulse water wheel supplied by a 9-in. pipe from a ditch 220 ft. above the mill. Surface equipment including shops, change room, offices, etc., are in keeping with the mill construction and modern methods employed in mining. There are other examples of mining progress in Eldorado County; but these two are particularly interesting in demonstrating what may be done and is being done by outside men in spite of the war conditions that for a year retarded progressive development. They illustrate another fact, that the really big things in California mining are not being done by California investors.

DENVER—Jan. 6

Leadville Produced 6,250 Tons of 25% manganese ore worth about $100 per ton during 1915.

The Employees in both the Portland and Golden Cycle mills at Colorado City have been given an advance in wages of flat 25c. each per day, where the wage has been under $3.

Primos Mining and Milling Co., feeling that one of the rules fixed in its contract with the Colorado Power Co. was unreasonable, cited the case to the state public utilities com-

mission and was sustained. The objectionable clause holds the mining company liable for any injuries sustained by persons from the power lines crossing the mining company's premises. It has been ordered canceled.

At the Arkansas Valley Smeltery, Leadville, two laborers were burned to death in a most peculiar accident, Dec. 15, and two others were seriously injured. The men were engaged in spraying the interior walls of the new bag-house with heated liquid tar by means of a hose leading from a tank over a fire. The hose burst, permitting the hot tar, under a pressure of 50 lb., to cover the men who were instantly enveloped in flames.

Elkton's Main Shaft (Cripple Creek district) is down 1436 ft. at which depth water level was encountered. As the water is lowering at an average rate of 21½ ft. per month, due to drainage by the Roosevelt tunnel, the company will continue sinking at the same rate. The 16th level is at 1,340 ft. A station for the 17th level is planned at a depth of 1465 ft. The breast of the Roosevelt tunnel is less than 500 ft. from the shaft and is handling about 13,000 gal. per minute.

Midwest Refining Co., composed principally of Denver stockholders, is in a most prosperous condition. The regular dividend rate has been officially changed from 4% to 6% and the company has acquired new territory in Elk Basin, on the Wyoming-Montana line. This new field presents special interest to geologists in the fact that there are proved three distinct zones of oil sand or rock, the upper, 60 ft. thick, the second, 80 ft. and the third as yet undetermined as to thickness.

Montezuma, the little, dormant mining camp in eastern Summit County, well up on the western slope of the continental divide, has been given renewed attention because of its notable bodies of sphalerite. Good lead-silver mines, formerly operated here, were closed down years ago, because of the heavy zinc penalty in smelting. Last summer, flotation was installed in the district and increased activities are promised for next summer. On Dec. 14, a fire destroyed about half the business part of the camp. Population is about 200.

Directors of the Colorado Springs Mining Stock Exchange have established new rules covering trades in mining stocks. Hereafter, on all stocks selling at 2c. or less per share, the least trade must be for 2,000 shares; on 2c. to 50c. stocks, the lot must be 1,000 shares; on stocks above 50c. per share, the minimum lot must be 500 shares. Moves in quotations are also to be regulated. Stocks selling between $2 and $3 must move at least one-half cent, while stocks selling above $3 must move up or down not less than one cent. The significance of this is that there will be no more quotations on this exchange in eighth and quarter cents, on the higher-priced stocks. The newly fixed commission charge is $2 per 100 shares.

Dry Colorado, besides the statistics of metal production, is at present the only topic for discussion among mining men in the state. For months after the prohibition law was passed last winter, there were all sorts of threats of litigation that would so interfere with the enforcement of the law that it would, in the end, become a farce. But the law was found to have its own teeth as well as the backing of a substantial part of the state's citizenship. Still the wise ones continued to assert that the mining camps would never go positively dry. As a matter of fact, however, the mining camps of the state are probably the towns that are doing their utmost to scrupulously follow out the letter and spirit of the law and there is no doubt regarding the "dryness" of every camp in the state. There will be fewer mine accidents and fewer interferences with mine production. The camps will be deserted by that class of "drones" and agitators whose presence was baneful. Already, Cheyenne is complaining of its receipt of Colorado's flotsam.

BUTTE—Jan. 6

Reports of Oil and Natural Gas—Drilling operations for oil and natural gas in various sections of Montana are received with increasing frequency. While the majority of enterprises are still in the first stages of development, with no infallible indications of striking oil or natural gas in commercial quantities, there are nevertheless a number of wells scattered throughout the state which are actually producing both. Whether the yield will be of a magnitude to warrant the planning of large enterprises dependent on oil or gas for fuel and power, is yet too early to predict. The state land office reports the leasing of large tracts of land for oil prospecting in Carbon, Teton, Musselshell, Dawson, Sheridan, Yellowstone, Stillwater and Cascade counties. A Billings syndicate began boring for oil this week in the field near Lovell, expecting to strike oil within a few hundred feet of the surface. In the Elk basin in Carbon County there are three producing wells and near Belfry in the same county many other wells are being drilled. One of them, upon striking the second strata of oil sand is reported to register a flow of 2,500 bbl. of oil a day. Near Glendive in Dawson County a big gas well was opened a few weeks ago by John Johns which is said to furnish sufficient gas for heating, lighting and cooking in Glendive and an additional amount for the operation of a prospective smelting or other industrial plant. While not all of the enterprises now in course of development will prove successful, there is no longer room for doubt that both oil and gas are to be found in Montana and that the exploitation of these resources will in time add enormously to the wealth of the state as well as to that of the individuals who have devoted both money and energy to the discovery and opening up of these resources.

In the Anaconda Zinc Properties in Butte are enough zinc ores to supply the entire capacity of the new refinery. Yet owners of zinc mines in the Cœur d'Alenes, in the Helena district, and independent owners in the Butte district have become imbued with the idea that the Anaconda company is going to put up a refining plant of such enormous capacity that they will all be able to send their ores to it. They are due for a hard bump when they finally awaken to the facts. It it estimated that about 1,000 tons of zinc ore per day will be sufficient to furnish the new plant with all the concentrates required. The Emma, Alice, Lexington, Poulin and East Gray Rock mines of the Anaconda company can alone furnish this amount for several years to come. It is not likely that the Anaconda company will accept any custom ore for that plant. The Clark interests are not allowing themselves to be fooled nor is the Butte & Superior. The former are getting out, through the Timber Butte concentrating mill, about 4,000 tons of concentrates per month. That mill is handling the output of the Elm Orlu mine alone. That Mr. Clark is seriously considering the erection of a zinc refinery to handle the concentrates of the Timber Butte mill, is generally known. He may build a plant large enough to handle the custom ores from the mines of the Cœur d'Alene district and other sections where zinc is abundant. His action will depend on developments in the spelter industry. Butte & Superior may also put up an electrolytic refinery similar to that of the Anaconda company. The output of this company for the last year has been double the proposed capacity of the new Anaconda plant.

SALT LAKE CITY—Jan. 5

A Bulletin on the Geology of the Big and Little Cottonwood mining districts has been issued by the United States Geological Survey, "A Reconnaisance of the Cottonwood-American Fork Mining Region of Utah," Bulletin 620-1 by B. S. Butler and G. F. Laughlin, with notes on the history and production of the district by Victor C. Heikes.

The Report of the State Coal Mine Inspector for the year ended Nov. 30, 1915, shows that 3,083,676 short tons of coal were produced; coke production amounted to 357,572 tons and gilsonite and other hydrocarbons to 39,044 tons. The coal production was not as large as last year, but both coke and hydrocarbons showed an increase. There was an average of 4,044 men employed in the mines. Fatal accidents showed a decrease. There were 194 accidents, 11 fatal, 28 serious and 155 minor. There were no labor troubles during the year and the wages and selling price for coal were practically unchanged.

The American Smelting and Refining Co. some time ago increased its payroll by about $1,000,000 annually, this additional amount going to foremen and those holding lesser positions; and it is now announced that an additional $600,000 will this year be paid as a bonus to all employees, who were not affected by the increase in wages—including boss carpenters, master mechanics, clerks, and others. The amount to be received in each case is to be proportional to the earnings at each plant, to the length of time of employment, and to the salary received. In addition to the $600,000, there will be set aside $250,000 to be used for the improvement of sanitary and social conditions at the company's various plants throughout the country, such as the establishing of bath houses, etc. This distribution is naturally of interest in this state, effecting as it does the employees of the Murray and Garfield smelting plants.

Statistics collected by the United States Bureau of Mines as to the distribution of ores and the situation of smelteries in the western United States, show that Salt Lake City is nearer to the bulk of production of most of the valuable metals than any other mining center; it being almost exactly the geographic center of the western metal production. This city is the most noteworthy center in the matter of flotation, there being three important organizations which have contributed to the art of floating minerals. These are: The General Engineering Co., which is exploiting the Callow flotation machine and process; the Utah Copper Co., which is

exploiting the Janney flotation machine; and the Department of Metallurgical Research of the University of Utah, under the direction of the local station of the United States Bureau of Mines, which is conducting research work on flotation, of importance to the industry in general.

HOUGHTON, MICH.—Jan. 7

The Following Notice Was Posted at the Calumet & Hecla, Centennial, Tamarack, the three mines of the Osceola Consolidated, the North and South Kearsarge, the old Osceola, La Salle, Superior Copper, Isle Royale, White Pine, Ahmeek, Allouez, Lake Milling, Smelting and Refining plant, Lake Superior smelting plant at Dollar Bay, and at all other related industries of the Calumet & Hecla and its subsidiaries:

Beginning Jan. 1, 1916, and continuing until July 1, 1916, the company will pay to all employees a premium of 10% on their monthly earnings.

This New Year's announcement means an increase in earnings to approximately 14,000 men of the total number of 20,000 employed in the mines of the copper country. Notwithstanding the fact that these men have been receiving the highest wages ever paid in this district for copper-mining work, they now are to participate in a further increase of 10%. The additional pay means at least $700,000 over and above the regular pay for the coming six months. It means that the monthly distribution of mining corporation pay checks in this district will hereafter total more than $1,700,000. A year ago today the mining company employees were working at wages below normal and on three-quarters' time. In March of 1915 the wages were restored to normal again and on May 1 the Calumet & Hecla and its subsidiaries paid a bonus to all employees amounting to $500,000. This bonus covered the pay lost by the men through the period of their decreased wages.

The Highest Price Ever Paid for Copper Land was agreed upon a few days ago when Thomas F. Cole, of Duluth, concluded arrangements for the purchase of the mineral rights underlying the village of Ahmeek, in Keweenaw County, adjoining the County of Houghton. The price was $4,000 an acre or $160,000 for the mineral rights under the tract. In the year 1903 when the Ahmeek mine became an assured success and the Allouez and other properties showed evidences of great futures the Ahmeek Land and Improvement Co. was organized. It purchased the surface rights to this same tract of land. The purchase was made from three interests, the Devereaux, Chandler and Northey, who, owning the territory jointly, retained the mineral rights. In the meantime the Ahmeek Land and Improvement Co. went ahead with the sale of lots. Eventually the village was organized and today it is one of the substantial property interests of the Michigan copper country. Recently Mr. Cole made extensive purchases of landed interests in this district, taking over the entire holdings of R. R. Goodell. The assumption is general that he likewise took over a large interest in what is known as the Douglass Copper Co., which owns a section that Ahmeek shafts must cross in the course of its future operations, at greater depth. To reach the mineral values of the Kearsarge lode in the Douglass tract or under the village of Ahmeek a shaft going through barren ground for a distance of 2,500 ft. would have to be sunk. The point of greatest interest is the price paid for mineral values on the Kearsarge lode, $4,000 an acre for copper rock which is to be mined only after sinking through 2,500 ft. of barren ground.

BELLEVUE, IDAHO—Jan. 4

The Bullion District is waking up, after a sleep of more than 25 years. The lease on the old Jay Gould, with a lead-silver production of two millions has been purchased by a syndicate, which also bonded the May Flower, and Bullion claims adjoining. The Bullion was owned by the heirs of the late E. W. Nash of the American Smelting and Refining Co. Regular shipments have been going forward from the Nitschke Lease during the last year, and the pay streak has been continuous as far as developed and stoped. They are well within the zone as defined by the upper workings of the Gould.

The Silver Fortune Group, located about 9 mi. northeast of the North Star Mine, on east fork of the Big Wood River was purchased by Dr. Paul Valtinke and associates of Salt Lake City about six months ago, and prospecting under the supervision of the Doctor himself, has been steadily going on. Within a month the vein lost by old prospectors in early days, who extracted several car loads of very rich ore from the very grass roots was recovered, and 6 ft. of a vein with well-defined walls, brought into view two fine streaks of high grade. About 20 in. of $300 ore on the foot, and 2 ft. of mixed ore on the hanging. A crosscut was immediately started 100 ft. below and has just come into the oreshoot.

DULUTH, MINN.—Jan. 8.

The iron-ore mining industry in St. Louis County, Minn., wherein is situated the major part of the Mesabi Range, will contribute $6,239,005 in taxes for 1916, being 66.8% of the total taxes of the county. The assessed valuation of the iron mining interests is $247,755,587.

The Steel Corporation will establish an uptodate company store at Morgan Park, a $75,000 building having just been completed for the purpose. C. Z. Wilson, Pittsburgh, Pa., has been given charge. The situation of the plant, a number of miles from the business center of Duluth, has necessitated this action, although protest has been made vigorously by the Duluth retailers' association.

PHILADELPHIA—Jan. 10

Sales at Auction in Philadelphia recently were: 1,000 Goldfield Daisy Mining Syndicate, $1 lot; 1,000 West Coast M. & S., $1 lot; 1,000 Searchlight Cons. M. & M., $1 lot; 1,000 Orleans Gold M. & M., $1 lot; 50 Montana-Tonopah Mines, 31c. each; 500 Rawhide Coalition, $2 lot; 500 Twin Mountain M. & M., $2 lot.

SEWARD, ALASKA—Dec. 28

It Rained Nearly All Day in Seward, Dec. 25, the temperature being several degrees above the freezing point. So far this year no zero temperatures have been experienced in Seward.

The Iditarod Gold Shipment was brought in by Bob Griffis, special messenger for Wells Fargo Express Co., who reached Seward on Christmas Day with over $500,000 in gold. The bullion weighed over 2,400 lb. and was hauled all the way from Iditarod by 38 dogs. Three sleds were used, 800 lb. of bullion being packed on each sled. At one stage of the trip a temperature of 55 deg. below zero prevailed. The bullion will be shipped to the States on the first available steamer.

MORENCI, ARIZ.—Jan. 6

For an Early Settlement of the Strike there seems to be a ray of hope. A. V. Dye, representing the managers, has been in the district for several days and has made several talks to the strikers. He publicly offered them $5 a day to come in on the assessment work, but after then, if the mines were to resume work, the old scale would stand. However, a few changes would be made: the scale would be advanced so as to take in copper at 25c., also there would be some change in the method of calculation. As a result, the strikers sent a telegram to the managers asking if they (the managers) would meet a committee of strikers if the Western Federation was eliminated. The managers replied that they would meet such a committee, provided they were satisfied the Western Federation was really out of it. Committee will meet the managers Jan. 11. The Detroit company will have finished its assessment work Jan. 10. There has been no real interference with the workers. However, there is some apprehension felt for the assessment workers at the time of their departure.

DOUGLAS, ARIZ.—Jan. 4

At Nacozari the Moctezuma Copper Co. and El Tigre Mining Co. have again commenced work at full capacity. When Villa and his army invaded Sonora all the mines both small and large shut down and the foreigners left the country as they did not wish to meet Villa after he learned that Carranza had been recognized. The railroad between Agua Prieta and Nacozari was out of commission on account of burned bridges and it is being repaired now and trains are running south as far as Esqueda and the people and supplies are transferred to Coa where another train takes them through to Nacozari. There is nothing in Sonora now except beans and some corn. Wherever the Villa army went, that part was destitute when it left and what provisions they could not carry with them were sprinkled on the ground. Many of the small operators have again come south and development will be continued where it was left off. There are only a few scattered bands in the Northern part of Sonora that are a danger to operations and these are being disposed of as rapidly as possible so that within the next 30 days the northern part of Sonora will be operating at about the same capacity as a year ago and if conditions do not change for the worse, inside of six month Sonora will have a bigger boom than it has ever had.

TORONTO—Jan. 8

Platinum Has Been Discovered in paying quantities in Munro Township, in Northern Ontario. Traces of this metal have been previously observed by prospectors in this locality, but the first really important discovery was made in the course of assessment work on a gold location known as the Quinn claims, situated about 1 mi. east of the Leyson-Dobie or Crœsus gold mine. The miners encountered a mineral which they did not recognize about three months ago, and it was only recently when the owners submitted samples to be assayed, that the value of the find was realized.

The Mining News

ARIZONA

Mohave County

MIDNIGHT (Chloride)—G. S. Holmes, of Salt Lake City, has purchased Midnight mine from Kean & St. Charles.

GOLCONDA EXTENSION (Golconda)—Shaft has reached 400 level. As soon as drifts at that level are well under way sinking will be resumed.

KINGMAN ZINC (Kingman)—Has suspended operations on its De La Fontaine property pending arrival and installation of 300-cu.ft. compressor.

UNITED EASTERN (Oatman)—Shaft being sunk from 565- to 765-ft. point has reached 665 level, where station is being cut and laterals started.

COPPERFIELD (Mineral Park)—Necessary camp buildings constructed and company has purchased two motor trucks. Shipments of 15% ore have begun.

TOM REED (Oatman)—Negotiations under way looking to consolidation of Tom Reed and United Eastern mines. Engineers have recently sampled both mines and consummation of the deal is expected within the next week or so.

ARGO (Oatman)—Gallows frame and concrete foundations for 25-hp. gasoline engine and 300-cu.ft. air compressor have been completed. Machinery will be installed in near future. Contract for first 200 ft. of proposed 400-ft. shaft awarded.

TUNGSTEN MINES (Kingman)—Shipping tungsten concentrates from mines in Aquarius Mountains, 40 mi. southeast of Kingman. Ore is concentrated at mine and hauled to Kingman by horses and motor trucks. Property embraces 60 acres; employs 14 miners. L. L. Stevens is manager.

BIG JIM (Oatman)—In crosscutting on 400 level, at 135 ft. from shaft ledge was struck, which now measures 40 ft. with footwall not yet reached; average value of ore between $15 and $20. Some streaks have assayed over $100. Impossible at this time to correlate this ledge with any of previously known deposits, but it is probably parallel to Tom Reed ledge.

Pima County

ATLAS (Silverbell)—M. D. Gaylord and associates, of El Paso, who have bonded the Atlas group for $200,000, will soon begin active operations. This property is situated near railroad and was formerly good copper producer.

Pinal County

ARIZONA HERCULES (Ray)—Two new churn drills received last week in December and are now in commission.

Yavapai County

SARATOGA (Crown King)—New mill now treating 150 tons daily from Crown King dumps.

WICHITA PLACER (Prescott)—Operations began Jan. 1 on company's ground at Lynx Creek.

TELSORI (Cherry C...k)—New 10-stamp mill put in commission and development resumed in mine.

MAJOR (Eureka)—Has leased 20-stamp mill and 8,300-ft. tunnel from Poland Mining Co. and is making daily shipments to Humboldt smelter.

BRADSHAW MOUNTAIN RY. (Prescott)—Account of increasing ore shipments to Humboldt smelter, train service between Prescott and Crown King is maintained daily instead of Tuesdays and Fridays, as it has been several years.

TUNGSTEN (Castle Hot Springs) — George Thompson shipped 2 tons of tungsten ore from his 2 claims 8 mi. east of Castle Hot Springs to Denver; net returns, $4,000. Had been working his locations less than a month.

PLUMMER & COOK (Castle Hot Springs)—Started work on 6 tungsten locations 6 mi. southwest of Tip Top; expect to be shipping soon. Ore will be packed to Castle Hot Springs, thence freighted to Hot Springs Junction.

CON. ARIZONA SMELTING (Humboldt)—Is shipping 350 tons a day from its Bluebell and DeSoto mines. DeSoto, which has lain idle for several years, was revived last summer; Bluebell has opened large body of good grade copper ore on 800 level.

RANDOLPH-GEMMILL (Crown King)—New mill now treating 200 tons daily from Crown King dumps. Iron concentrates carrying gold and silver are shipped to Humboldt. Zinc concentrates are shipped to Iola, Kan.

CALIFORNIA

Amador County

PINE GROVE (Pine Grove)—Boiler and engine rooms recently destroyed by fire being rebuilt; mining will soon be resumed.

SOUTH EUREKA (Sutter Creek)—Double dividend of 5c. per share, amounting to $30,988, has been paid for November. This makes a total of $230,988 paid in the 11 months of 1915. The November report shows recovery of $51,002 from 12,050 tons of ore; operating expenses, $36,027; or a profit of $14,975. The mine and mill employ 250 men. W. H. Schmal, superintendent.

Butte County

RALSTON DEVELOPMENT CO. (San Francisco)—Permitted to sell 20,000 shares at $3 per share to net not less than $2.50 per share and to issue to W. C. Ralston in exchange for option to purchase properties of Burlington Gold Mining Co. in Forbestown district one share of stock for each four shares sold for cash. Property situated partly in Butte and partly in Yuba County. Purchase price, $100,000.

Calaveras County

UTICA (Angels Camp)—Reported that 100 underground men were laid off and Cross shaft will be closed temporarily. Deepening shaft 300 ft. from 2,700 level contemplated. The Stickles mill still running on ore from Gold Cliff and a reserve supply from Utica.

Eldorado County

GUILDFORD (Placerville)—Reported that three masked men held up millman, Warren Sackett, Dec. 24, and robbed mill of about $1,200 worth of amalgam. Mine is owned and operated by A. Baring Gould.

EUREKA SLATE (Slatington)—Two shanties are splitting 14 squares of slate a day and quarry is in shape to provide material for four more shanties, which will be put on splitting slate as soon as men can be secured. Tramway on south side is about completed and repair of north side will follow. Forty men now working. Long rope being stretched across quarry for handling of waste, at cost of 7c. to 10c. a yard, which is said to be large saving over old method of car tramming.

Kern County

VIENNA (Randsburg)—While doing annual assessment work Val. Schmidt, pioneer in Stringer district, disclosed ledge 20 in. wide that will mill $20 per ton.

Napa County

UNION HILL (Grass Valley)—Union Hill is only mine in district known to produce scheelite. Three lots have been shipped to Denver, and for one lot settlement was made on basis of $1,000 a ton for 30% ore. Scheelite was encountered recently in raise from 600 level and followed to 300 level.

Orange County

POTASH from seaweed is purpose of company organized by Dr. S. R. Oppenheim, of Santa Ana. Construction of plant at Long Beach is contemplated, at cost of $15,000.

Placer County

BANNER (Auburn)—Banner Consolidated Mining Corporation organized to purchase and operate property reported to have failed to complete deal and has issued no shares. Permit has been revoked.

AMERICAN GORGE MINING CO. (Auburn)—Permitted to issue 100,000 shares to Charles N. Stone, William S. Parsons and R. B. Parsons in exchange for unpatented mining claims near Gorge station; and to sell 398,997 shares at 5c. per share to net not less than 90% of selling price.

San Bernardino County

ATOLIA'S GROWTH requiring the laying out of a new townsite has created a demand for motor stage service and general automobile traffic between Atolia and Randsburg and other camps in region. Automobile service may now be secured day or night between Atolia and any point in southern California, and extending into Nevada and Arizona.

Tulare County

PORTERVILLE MAGNESITE (Porterville) — Company composed of San Francisco men has taken option on 76 acres situated north, near Zante station, on Southern Pacific R.R. This is in addition to recent purchase of large deposit 2 mi. east of Porterville.

Tuolumne County

ATLAS (Jamestown)—Reported that new owners have taken charge and active development will begin as soon as electric transformer can be installed.

RAWHIDE (Jamestown)—Additional electric power secured by construction of new transmission line from Copperopolis. New electric hoist and headframe are in place. Electric pumps have been ordered and large amount of machinery is arriving from Blair, Nev. Property is being reopened by Pittsburg-Silver Peak Co.

COLORADO

Clear Creek County

NORTH STAR (Georgetown)—Preparations are being made for resumption of development work in adit tunnel.

KEY WEST (Georgetown)—Development is in progress in the adit level and a raise is being made on the vein. Small pockets of rich gold ore have been opened.

LAKE (Idaho Springs)—I. D. L. Leasing Co. has advanced a drift from bottom of 50-ft. shaft sunk from Big Five tunnel level and opened 2-ft. vein of $100 ore.

KAVERNE MILL (Dumont)—Plant being completely overhauled by McCall & Brooks; designed to treat custom ores by concentration and amalgamation; capacity 50 tons per day.

San Miguel County

TOMBOY (Telluride)—Return for December, 1915: Mill ran 29 days; crushed 13,000 tons of ore; yielding bullion, $44,400; concentrates shipped, $41,500; expenses for period, $59,200; profit, $26,700.

Teller County

RUBIE MINING AND MILLING (Cripple Creek)—Company incorporated Nov. 27, 1915, proposes to erect cyanide mill for treatment of ores from Rubie and Lafayette mines and dumps. Will be called Worcester mill; will use straight cyanide process; and have crushing capacity of 50 tons per day. S. A. Worcester is president and general manager.

GEORGIA

Chatham County

SAVANNAH KAOLIN (Savannah)—Filed incorporation papers to engage in mining and marketing of clays, ore, etc., at Gordon, Wilkinson County. Capitalization, $500,000.

Lumpkin County

FINDLEY RIDGE M. & P. (Dahlonega)—Expect to add cyanide plant early in 1916; is dropping 30 stamps now.

IDAHO

Shoshone County

GOLDEN CHEST (Murray)—Made two shipments of gold-tungsten ore, reported to be worth $15,000, or $100 per sack. Cost of recovery about 10% of net return. Is installing jig to treat material too fine for hand-sorting. Rush J. White, of Wallace, is manager.

OLYMPIA (Wallace)—This group of Cañon Creek claims sold by A. G. Kerns and associates to Green Hill-Cleveland company for $150,000; terms, $5,000 cash, rest later. Claims adjoin Green Hill-Cleveland on west and extend westward to Ninemile Creek. Exploration work will be pushed from Green Hill-Cleveland workings.

ANTIMONY-SILVER (Pine Creek)—Shipment of 200 tons recently sent East averaged 54% antimony. Company is building concentrator and pushing development at mine, employing total of 56 men. Shaft will be sunk from 150 to 250 level. Management expects to ship 2 cars of concentrate weekly, commencing about middle of January.

DOUGLAS (Kellogg)—Has been taken under three-year bond by Anaconda Copper Mining Co., for $36,000, equivalent to 30c. a share on the issued capitalization. Said that Anaconda will build mill and install compressor plant and mining machinery. Product is high-grade complex lead-zinc ore, difficult to handle by ordinary methods, but said to be easily handled by new electrolytic process of Anaconda.

ILLINOIS

Cook County

GENERAL CHEMICAL (South Chicago)—Is building $100,000 plant at South Chicago to manufacture sulphuric acid, and $150,000 plant at West Hammond for manufacture of various chemicals.

MICHIGAN

Iron

SPEIS (Iron River)—While drilling for shaft, orebody 80 ft. thick was struck. Suitable ground found for shaft and sinking will be started. Contract let for 16 buildings; work already started.

CLEVELAND - CIFFS IRON (Ishpeming) — Work has started on new power plant on Dead River. Pole line extended from Maas mine station. Current will be used to operate compressor for rock drills. All of machinery has been ordered.

AURORA (Ironwood)—Work started on 4-compartment steel and concrete shaft similar to "C" shaft of East Norrie mine, recently completed. New shaft is designated "E" shaft and will be sunk at an angle of 68°. Size, 19 ft. 4 in. by 10 ft. Location, 250 ft. southeast of old No. 1 shaft.

BERKSHIRE (Iron River)—Orders given first of year to resume operations. Property closed two years but pumps were in operation. New steel headframe and crushing plant to be constructed. Electric pumps, hoists and compressor to be ordered. Present equipment will be used until new machinery is on the ground. This is last of Iron River mines to get going again. Every property in district now working.

MINNESOTA

Cuyuna Range

FERRO (Ironton)—Mine nearly unwatered and new brick power house completed.

CUYUNA RANGE POWER—W. D. Stoner, general manager, announces that company will construct another dam, thereby doubling its present production of 3,000 hp.

CUYUNA-DULUTH (Ironton)—This shaft of American Manganese Manufacturing Co. will resume operations after idleness of many months.

Mesabi Range

MEADOW (Aurora)—Cleveland-Cliffs Iron Co. will begin operations at once with 125 men.

ALEXANDRIA (Chisholm)—Shaft completed; total depth 137 ft. As soon as the station is cut and sump completed, drifting to ore will be started. Mine will be shipper this year.

MINORCA (Virginia)—After operating life of 8 yr. pumps are now being pulled and surface plant dismantled. Republic Iron and Steel Co. plan to permanently abandon the operation.

GLEN (Chisholm)—Ore being hauled underground and on surface by electric motors. New engine and 250-volt d.-c. generator installed. Increase in production 10% expected to result.

ST. JAMES (Aurora)—Force of 200 men will be put to work at once. Shaft was sunk and surface plant installed 10 yr. ago, but no ore was taken out. Corrigan, McKinney & Co. are operators.

OLIVER IRON MINING (Eveleth)—Steam-shovel and locomotive men who rendered efficient service during 1915 were given bonuses last week. Over $9,000 was distributed in Eveleth district.

MONROE (Chisholm)—Wire netting being placed between skiproad and ladderway in recently relined Monroe shaft. Advantages over customary board partitions are longer life, permits admission of light and air to ladderway, saves space.

DEAN (Buhl)—Butler Bros., of St. Paul, awarded contract for removal of 1,000,000-yd. overburden, which will require use of three steam shovels and 170 and 200 men for ensuing six months. Contractors have just finished stripping 4,000,000 yd. from same property; said to be largest stripping contract ever let. Property operated by Tod-Stambaugh Co., sublessee of Great Northern interests.

Vermilion Range

McCOMBER (Tower)—Osterberg & Johnson have placed diamond drill rig in bottom of shaft, on 200 level; will explore from there. Also planned to unwater old shaft near lake and continue exploratory work there.

VERMILION CONSOLIDATED (Tower)—Mines of Vermilion Consolidated & Extension Co. will be started as soon as tracks can be laid to property. About 90 days will be required to complete extension of Iron Range road. Machinery necessary has been on ground some time, having been transported by teams. Ore runs high in manganese; some samples high as 55.57% manganese; average of all samples more than 50% manganese. Phosphorus is very low.

MISSOURI—KANSAS—OKLAHOMA

HODGE (Carterville, Mo.)—Will erect mill on lease on Davey land, north of Carterville; capacity 150 tons; will use gas for power.

BURCH & CO. (Carterville, Mo.)—To build new mill on lease on Conner land, situated west of Carterville; will be of 200-ton capacity.

CHATMAN & LONGACRE (Commerce, Okla.)—Have new lead and zinc concentrating plant about completed; capacity 200 tons in 10 hr.; cost $25,000.

C. E. HART (Lincolnville, Okla.)—Has his new mill about ready to start. Mill is situated on Frank Buck land near Lincolnville; capacity 250 tons in 10 hr. Cost $20,000.

CRAIN (Joplin, Mo.)—Will erect 200-ton mill on lease of 16 acres of Lindsay land, situated north of Joplin; two shafts already down to ore. Mill will use electricity. Hall S. Crain is manager.

JACK HAVARD MILL (Joplin, Mo.)—Has operated steadily for 10 yr., on Continental Zinc Co. land west of Joplin; will be rebuilt; will be 200-ton capacity. George Lurwich is superintendent.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—Treatment tests of ores from company's mines being made by G. W. Wood to determine character of mill to be installed in near future. Mill will probably be continuous, counter-current, decantation cyanide plant with Dorr equipment. At present about 40 men are working at Golden Leaf and other mines controlled by company.

Broadwater County

KEATING (Radersburg)—Construction of big mill to treat low-grade gold ore blocked out in Keating mine is contemplated.

Carbon County

ELK BASIN (Elk Basin)—Another well drilled in Elk Basin, struck flow of oil; normal production estimated at 4,000 bbl. a day.

Silver Bow County

ANACONDA (Butte)—Neversweat has resumed after shutdown of nearly two years.

BUTTE & LONDON (Butte)—Sinking of shaft carried to depth of 1,250 ft.; work is progressing rapidly.

DAVIS-DALY (Butte)—Last three cars of ore sent to Washoe from Colorado mine netted close to $1,000 per car.

BUTTE & ZENITH CITY (Butte)—Unwatering of shaft will be rushed as fast as possible. The shaft has depth of 670 ft. and as soon as it is free of water, work of sinking to 1,500 level will begin.

PILOT-BUTTE (Butte)—Development work on 2,500-ft. level of company's mine opening up finest body of copper ore ever found in mine. Sixty tons of ore per day are being mined, averaging over 5% copper, which pays for all mining expenses and development work.

BULLWHACKER (Butte) — Wall - Jackman - Heilbronner syndicate has taken lease on company's property for 18 months with option on majority of stock. Everything is in readiness for resumption of operations within a day or two. Ore will be shipped to Pittsmont and Washoe smelteries. Part of ore will be treated by leaching process.

BUTTE & SUPERIOR (Butte)—Output for December approximately 50,900 tons of ore, resulting in over 15,000 tons of concentrates. Zinc recovery estimated at 16,000,000 lb. November and December best in history of company. Total zinc production for quarter ending Dec. 31 was over 47,000,000 lb., or 6,000,000 lb. greater than for preceding quarter.

NEVADA

Clark County

BOSS (Good Springs)—Mine under option to California capitalists for year has reverted to original owners. Terms of option prevented any mining and shipping of platinum during last year. F. A. Hale, formerly of Salt Lake, is manager.

Churchill County

NEVADA WONDER (Wonder) — Year ending Sept. 30, 1915, most successful in life of mine, according to annual report. Ore production was 58,124 tons; average value, $15.97 per ton; 1,199,245 oz. of silver and 10,279 oz. of gold were produced.

Esmeralda County

CRACKER JACK (Goldfield)—Plans were perfected for a reorganization; new company to be known as Reorganized Cracker Jack Mining Co.

GOLDFIELD CON. (Goldfield)—Estimated production for December: Total tons mined, 35,000; gross extraction, $212,000; operating expenses, $161,000; net realization, $51,000.

JUMBO EXTENSION (Goldfield)—Preliminary estimate for November: 2,654 dry tons mined; gross value, $70,000; freight, treatment, sampling and smeltery loss, $30,000; mining and development, $15,000; net realization, $25,000.

GREAT BEND (Goldfield)—Has finished setting four-stage centrifugal station pump on 400 level with capacity far in excess of present requirements, and is now drifting east on vein to get under shoot exposed in winze from 250 level.

ATLANTA MINES (Goldfield)—Shipments of medium-grade ore for month at rate of carload every day. About two-thirds of value is in copper content. Production mostly from 1,580 level. Winze on 1,750 level encountered heavy flow of water; temporarily discontinued.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—During 1915 produced $416,084 in gold and silver from 4,509 tons of ore. Ore handled by mill which came from all parts of mine, averaged about $93 a ton. This is believed to rank in average with any mine in world over same length of time.

ROCHESTER MINES (Rochester)—From 52,282 gross tons of ore $1,015,345 was produced up to last day of December, 1915; inception of operations by lease and company work early in 1913. Through the acquisition of additional water rights, for mill purposes, intimated that large addition to reduction plant is to be built during coming year. Additional water is sufficient to treat about 500 tons daily; present mill is handling 135 tons a day.

Nye County

TONOPAH ORE PRODUCTION for week ended Jan. 1 was 7,567 tons, valued at $162,166, compared with 10,423 tons for week previous. Decrease was largely owing to holidays. Producers were: Tonopah Belmont, 2,272 tons; Tonopah Mining, 2,150 tons; Tonopah Extension, 1,600 tons; Jim Butler, 600 tons; West End, 594 tons; North Star, 54 tons; miscellaneous leases, 292 tons.

TONOPAH EXTENSION (Tonopah)—At Victor Shaft on 1,540 level long crosscut has encountered Murry vein, exposing 4 ft. of low-grade quartz.

TONOPAH BELMONT (Tonopah)—Morning of Dec. 19 steel-concrete refinery building, which is isolated from rest of plant, was completely destroyed by fire resulting from break within building in pressure-oil-line to furnace. Accident will result in no delay to regular operations.

ROUND MOUNTAIN MINING (Round Mountain)—Total net profits, lode and placer, for six months ended Sept. 30, 1915, were $58,013. Mill treated 25,343 tons of ore, recovering $142,569 in bullion at a profit of $33,852. At placer, 18,150 yd. of gravel returned $33,102 in bullion, with some bed-rock still to be cleaned, resulting in a profit of $24,178. Total cost of Jet Creek pipe-line, water rights and placer equipment was $192,887.

NEW JERSEY

Warren County

EMPIRE STEEL AND IRON (Oxford)—At Washington iron mine, shaft being sunk rapidly has now reached depth of 700 ft. on incline; necessary to sink 300 ft. farther to reach present lower workings. By Apr. 1 expected that new shaft and new magnetic-separation plant, replacing present unit, will be in operation. Improvements will increase output of Washington mine 50%. Company at present shipping from Oxford and Mount Hope mines about 30,000 tons of ore, averaging approximately 60% Fe.

NEW YORK

Erie County

SOLVAY PROCESS (Buffalo)—Will erect 60 byproduct coke ovens on ground adjoining steel plant being erected by Wickwire Steel Co.

TENNESSEE

Hamilton County

AMERICAN ZINC (Chattanooga)—Company's zinc mines, near Chattanooga, were flooded on Dec. 23, closing down for about 30 days. Mines located considerable distance from Holston River, but unusually high tide caused water from river to seep through limestone ledges lying between river and mines. Estimated that 70,000,000 gal. of water will have to be pumped to unwater mines.

UTAH

Beaver County

CEDAR-TALISMAN (Mulford)—Reported contemplating erection of small electrolytic zinc plant similar to experimetal plant of Anaconda.

PALOMA GOLD AND SILVER (Milford)—Silver-lead ore of shipping grade cut at 375 ft. in shaft in Star district. Ore occurs at contact of monzonite-porphyry and limestone. Additional men have been added to working forces.

Juab County

YANKEE (Eureka)—New tunnel, driven to reach recently opened body of silver ore, showed ore to be 18 ft. thick.

Salt Lake County

RECENT SNOW AT ALTA and in Little Cottonwood has improved ore hauling.

CARDIFF (Salt Lake)—Twenty teams hauling ore; shipments at present amount to 40 tons a day.

SOUTH HECLA (Alta)—Twenty-odd teams are hauling; shipments amount to car of ore daily.

MICHIGAN-UTAH (Alta)—Tramway from mine to Tanner's Flat repaired; ore shipments over line resumed.

SELLS (Alta)—Ore of recent strike has been followed 150 ft. and is up to 12 ft. in thickness. Occurs in brecciated zone and is similar to South Hecla orebody. Upward of 250 tons are broken and stored in bins and in mine, awaiting shipment.

Summit County

ONTARIO SILVER (Park City)—Shipments of siliceous ore carrying silver and gold recently made to Garfield.

NAILDRIVER (Park City)—Active development work being done at this property in eastern part of camp, and some ore is being mined.

SILVER KING CONSOLIDATED (Park City)—It has been decided to drive tunnel, beginning on Sullivan ranch or William M. Ferry property to prospect company's claims in Thanyes Cañon, reaching main workings at 1,000 level.

VIRGINIA

Rockbridge County

ROCKBRIDGE MANGANESE (Rockbridge)—Has completed mill to treat manganese ore at Rockbridge and will start operations soon. George A. Horton is president and H. L. Whitney secretary.

WASHINGTON

Stevens County

GREAT WESTERN (Northport)—Mine 7 mi. southwest of Northport being operated by Norman Mines Co. has signed contract for 500 tons of ore to be forwarded to Donora, Penn.

Spokane County

BIMETALLIC MINING (Spokane)—Capitalized for 100,000 shares, par $1 each, recently organized by Spokane men, plans to begin active construction of new 100-ton capacity electro-chemical ore-treating plant at Turk, 25 mi. west of Springdale, Wash. Plant will be equipped with Field's electro-chemical process. Estimated cost, $25,000.

WISCONSIN

Zinc-Lead District

BELL (Platteville)—New shaft is down to good disseminated zinc ore on Bell land, 2 mi. west of Platteville.

B. M. & B. (Lancaster)—Boch, Meyer & Brown will build roasting plant, at Mifflin, to treat concentrates of B. M. & B. and Biddick mines.

WISCONSIN ZINC (Platteville)—Contemplates the erection of central power plant to furnish electric drive to its mining properties in Benton-New Diggings camp.

BIG TOM (Platteville)—Theo. Miller and others have acquired lease and hoisting plant, at Mifflin, and will open up property and equip with mill. Shaft is sunk and crosscut driven through good body of zinc ore.

CANADA

Ontario

DOME EXTENSION (Porcupine)—Shareholders meeting authorized the sale of 999,999 shares of treasury stock at 25c. a share.

DOME CONSOLIDATED (Porcupine)—Is the name of a new company formed to take over the claims that formerly belonged to the American Goldfields.

SWASTIKA MINES LIMITED (Swastika)—Is the name of new $2,000,000 company formed to operate old Swastika mine, which was purchased by Beaver company of Cobalt.

LAKE SHORE (Kirkland Lake)—Shaft is down to 300 level where station has been cut. Crosscutting will be undertaken to pick up oreshoot which yielded rich ore on 200 level.

CONIAGAS (Cobalt)—Annual report shows ore reserves of 10,315,504 oz. of silver. Mill treated 55,437 tons of ore and made average extraction of 82.6%. The total cost was 16.87c. per ounce.

HOLLINGER (Timmins)—The 4-weekly statement for period ended Dec. 2 shows gross profits of $210,558 from treatment of 29,448 tons of ore; average value, $10.99 per ton; working cost of $3.34 per ton milled; mill also treated 11,214 tons from Acme.

TOUGH OAKES (Kirkland Lake)—Kalgoorlite, a telluride not previously known to occur in Canada, has been encountered on 400 level. It contains more silver than gold with showing of mercury.

STANDARD (Porcupine)—This property, south of Dome Lake, acquired by recently organized Porcupine Premier company, capitalized at $1,000,000. No. 1 shaft will be put down to 500 ft. and development pushed on 100 level.

MEXICO

Sonora

SIX BIG MINING COMPANIES operating in Chihuahua and Durango have sent officers and employees from El Paso to their mines and will begin work at once. The Mapimi smeltery, the Peñoles Mining Co., the Mines Company of America, in the Parral district, and the Dolores mines, expected to start up during the week of Jan. 2. Over 10,000 men will be given employment. The Chihuahua smeltery will also start up, giving work to several thousand men. Company has placed contract for several thousand carloads of coal.

GREENE-CANANEA (Cananea)—Mines, mills and smeltery running at practically full capacity.

SAN JOSE (Nacozari)—F. A. Montgomery and associates have acquired this property of 19 claims under bond and work will be begun about Jan. 15. Plans include complete overhauling of amalgamation plant and installation of 100-ton cyaniding plant. Expects to work 150 men in mine and mill.

SOUTH AMERICA

Bolivia

WEST VIRGINIA CAPITALISTS behind negotiations of Messrs. Berry and Luitwieler at La Paz for electric smelting concession in Bolivia are B. W. Peterson and J. C. MacKinley, of Wheeling, W. Va. They are also interested in negotiations for $2,500,000 Bolivian loan, designed for construction of La Paz-Yungas Ry., 220 kilometers in length.

Chile

ANDES EXPLORATION CO. (Chañaral)—This company, controlled by Anaconda, is developing low-grade steam-shovel propositions at Portrerillos, about 60 mi. from the coast, and 250 mi. north of Chuquicamata. Tonnage developed is reported unofficially as 100,000,000 and averages 1½% copper.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan)—In October, 200 stamps running 29.95 days crushed 25,422 tons of ore; gross receipt, $137,346; net profit, $59,677. November bullion amounted to $144,805, from 24,269 tons of ore. Cable advices put clean-up for December at $144,500. Value of ore milled was above average.

The Market Report

Metal Markets

NEW YORK—Jan. 12

The most interesting market last week was the lead market in which there was a sharp advance, followed with a few days by softness. Copper advanced further and held very strong. In tin there was a sharp decline. In spelter there was not much change, but the tone was considerably stronger.

Copper, Tin, Lead and Zinc

Copper—The advance continued on Jan. 6, on which day large business was transacted, chiefly at 23½c., r. t. On the two days next following, 24c., r. t., was realized, especially for early deliveries, while later deliveries were available at ¼@½c. less, and large business was again done. During these days there was also rather large selling for export, especially to France, Great Britain temporarily out of the market. The asking price in England of the principal producers was £117 per ton.

The sales to France brought very high prices—£119@121, the latter for prompt shipments. With exchange at 4.74, £121 is reckoned at 25.60c. However, these high prices shrink very much when reduced to the basis of f.o.b. New York, the current freights being 1½c. per 100 lb. for prompt shipments, and 1¼c. for forward. Costs, insurance and freight are variously reckoned at 1⅞@2c. per lb. on prompt shipments and 1⅝@1¾c. on later. Sales to France that were made in the early part of the week were computed as netting 23@23¾c.

In the latter part of the week the domestic inquiry relaxed considerably. On Monday a relatively small amount of copper was offered for resale by consumers and certain lots were taken at 23½c., r. t., while on Tuesday some copper was reported sold by dealers at 23⅛c. The asking price of the producers remained 24c., r.t., but large consumers reported that they had been able to buy at less, and on Jan. 12 copper was available from several producers at 23¾c., regular terms.

Dispatches from London said that the Ministry of Munitions had notified consumers in Great Britain that they must not buy more than 50 tons of copper in one lot, and must not pay more than £100 a ton for refined copper. While no communications respecting the exact terms of this measure have yet been received here, the governmental restriction is believed to be correctly stated in the main. American producers consider that this affects their interests in no wise, but rather look upon it as probably being beneficial, inasmuch as it will tend to restrain the operations of dealers and speculators and contribute toward the steadiness of the market.

Copper Sheets have been advanced and the base price is now 30c. per lb. for hot rolled and 31c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire is 25@25½c. per lb., carload lots at mill.

Tin—This market declined sharply after the trade got over the scare arising from the Mediterranean rumors. The volume of business that was transacted was rather light.

Lead—The large number of inquiries that came into the market on Wednesday, Jan. 5, resulted in business on Jan. 6, following which independent producers found themselves able to realize a premium over the price of the A. S. & R. Co. In the afternoon of Jan. 7 that company advanced its price to 5.90c., New York, the independent producers following. After the advance, however, business became rather dull, and dealers and speculators attempting to liquidate, the price eased off.

Spelter—This market was very dull. A considerable tonnage was sold for delivery during the second quarter, but there was no general demand for deliveries in the first quarter, nor was there pressure to sell. The business for prompt delivery was small—carload lots, etc.—and was of but trifling consequence. Consumers are believed to have covered their requirements pretty well up to the end of March. Smelters have sold very well for that time, but probably have considerable February and March metal yet to sell. However, for the moment they are in no wise urgent about it. Many producers would like to sell liberally for the second quarter, but do not find buyers generally eager to enter into such contracts.

Spelter for prompt delivery, in small lots, fetched about 17@17¼c. during the last week. February was quoted at 16@16½c., and March at 15¼@15½c. during the early part. The average for first-quarter delivery was 16c. Sales for second-quarter delivery were made at 14¼c. In the latter part of the week the market eased off, first-quarter spelter being available at 15½c., while second-quarter was sold at 13¾ cents.

Zinc Sheets are in demand, but the base price still remains at $23 per 100 lb., f.o.b. Peru, Ill., less 8% discount. Railroad embargoes and delays are still making some trouble about deliveries.

DAILY PRICES OF METALS IN NEW YORK

Jan.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
6	4.7575	56⅜	23.00 @23.50	42	5.75 @5.80	5.67½ @5.70	15.50 @16.50
7	4.7725	56⅜	23.25 @23.75	42	5.75 @5.90	5.67½ @5.82½	15.50 @16.50
8	4.7625	56¼	23.37½ @23.75	41½	5.90	5.82½	15.50 @16.50
10	4.7525	56¼	23.50 @23.75	41½	5.90	5.72½ @5.82½	15.00 @16.00
11	4.7550	56¼	23.37½ @23.62½	41½	5.80 @5.90	5.70 5.75	15.00 @16.00
12	4.7675	57	23.37½ @23.62½	41	5.80 @5.90	5.70 @5.75	15.00 @16.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Jan.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
6	26⅞	91	90	114	24.26	175¼	175¾	31½	6.74	90	19.13
7	26⅛	87½	87½	114	24.29	173½	174	32¼	6.98	90	19.16
8	26⅛	.....	.....	.....	.....	.....	....	.....	.....	....	....
10	26⅛	86	86	114	24.24	175	175¾	32¼	6.95	88	18.73
11	26⅛	84¾	84¾	114	24.25	173¼	174½	31	6.60	90	19.12
12	27	84⅞	84¾	114	24.28	173½	174½	29¼	6.23	89	18.95

The above table gives the closing quotations on London Metal Exchange, All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices. in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Jan. 12

Aluminum—The market is quieter and transactions have been on a moderate scale. Quotations are 54@56c. per lb. for No. 1 ingots, New York.

A strike is reported at the Niagara Falls works of the Aluminum Co. of America, with work stopped for several days.

Antimony—The market has been quiet with no heavy business reported. Quotations are strong at 41@42c. per lb. for Chinese and other outside brands. Cookson's is very scarce and is held at 56c. per lb. Antimony ore is in better supply and is quoted at $2@2.20 per unit.

Nickel—The market is steady with a good business. Quotations for ordinary forms are 45@50c. per lb. A premium of 5c. per lb. is charged for electrolytic nickel.

Quicksilver—The metal is scarce and the demand is good, prices having advanced to a high point. The New York price is $180 per flask of 75 lb. for large quantities; $180@190 for smaller orders. San Francisco quotes $140@150 early in the week, advancing to $160 per flask today. London price remains £16 15s. per flask, with no discount from second hands.

Minor Metals—Current quotations for **Bismuth** are $4 per lb., New York.—**Cadmium** is quoted as 7@8s. per lb. in London; $1.75&1.90 per lb., New York.

IMPORTS AND EXPORTS

Mineral Exports of Spain 10 months ended Oct. 31, as reported by "Revista Minera" in metric tons:

	Metals		Ores, etc.	
	1914	1915	1914	1915
Iron	20,375	106,870	5,584,125	3,664,358
Copper	16,098	14,957	76,787	26,971
Copper precipitate	8,552	9,340	.....	.....
Lead	127.262	136,782	1,580	716
Zinc	2,791	3,659	65,468	25,889
Quicksilver	1,273	705	.....	.....
Manganese	.....	.....	3,308	7,660
Pyrites	.....	.....	2,452,064	1,686,593
Salt	.....	.....	467,183	420,466

Imports of coal were 1,437,120 tons, a decrease of 755,134 tons from 1914; of coke, 155,633 tons, a decrease of 152,387 tons

Imports and Exports of Metals other than iron and steel in Great Britain, 11 months ended Nov. 30, long tons:

	Imports		Exports	
Metals:	1914	1915	1914	1915
Copper	161,199	184,752	48,578	29,413
Tin	37,405	36,927	40,606	35,135
Lead	203,612	236,968	47,761	63,337
Zinc	117,033	78,978	7,288	8,216
Quicksilver	1,299	1,018	662	397
Minor metals	6,594	4,784	22,761	17,856
Ores, etc.				
Tin concentrates	21,872	30,315	.....	.....
Pyrites	753,662	808,176	.....	.....

Copper includes contents of ore and matte. Exports include reëxports of foreign material.

Gold, Silver and Platinum

NEW YORK—Jan. 12

Gold—Some gold is still coming from London, but the amount is much less than in December.

Gold production of West Africa 11 months ended Nov. 30 was 383,633 oz. in 1914, and 374,457 oz. in 1915; a decrease of 9,176 oz. last year.

Transvaal gold production in December is cabled at 781,111 oz., only 98 oz. more than in November. This makes the total 9,003,671 oz.—or $186,105,890—for the year 1915; an increase of $12,929,747 over the previous year.

Palladium—The latest sales reported are at $45@50 per oz., New York.

Platinum—There is no material change in the situation, supplies being scarce and prices very high. Sales are reported at $88@95 per oz. for refined platinum.

Our Russian correspondent writes that there is a heavy demand for platinum from abroad and another sharp rise in prices has taken place. General opinion is that a still further advance is inevitable. Quotations for crude metal, 83% platinum are 16.20@16.30 rubles per zolotnik at Ekaterinburg; 62,000@63,000 rubles per pood at Petrograd. These prices are equivalent to $61.10 and $61.25 per oz., average.

Silver—The market has continued steady with a slightly rising tendency. Purchases are chiefly made on the other side for mintage purposes. India inquiry is very moderate.

Shipments of silver from London to the East Jan. 1 to Dec. 22, as reported and valued by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£5,219,500	£3,709,000	D. £1,510,500
China	42,000	7,000	D. 35,000
Total	£5,261,500	£3,716,000	D. £1,545,500

Buying from India has been light for the week; while China has been a seller rather than a buyer.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 8

Blende, high price $112; base per ton 60% zinc, premium ore $110@111; medium grades $105@95 and lower grades down to $90; calamine, per ton 40% zinc, $80@70; average selling price, all grades of zinc, $99.06 per ton. Lead, high price $77; base per ton 80% metal contents $70@76; average selling price, all grades of lead, $74.22 per ton.

SHIPMENTS WEEK ENDED JAN. 8

	Blende	Calamine	Lead	Values
Totals this week	14,339,140	2,086,240	2,517,940	$908,990

Blende values, the week, $747,040.

Calamine values, the week, $68,510.

Lead values, the week, $93,440.

In the purchase of lead ore the Picher Lead Co. of Joplin is greatly outdistanced, holding its price down to $70 base after the advance of pig lead, and permitting the St. Louis Smelting and Refining Co. and the Granby Mining and Smelting Co. to purchase the bulk of this mineral on a higher price level. Blende ore prices were lowered $4 to $5 on premium grades, and $10 on some low-grade ores. The New Jersey Zinc Co. came into this market in mid-December for over 1,000 tons, and it is reported here this company cleaned up everything in the Wisconsin field that was purchasable. For the first week of a new year the shipment is extraordinary, and there seems plenty of strength.

PLATTEVILLE, WIS.—Jan. 8

The base price paid for 60% zinc ore, for the first week of the new year, was $106@107 per ton. The base price paid for 80% lead ore was $72@74 per ton.

SHIPMENTS WEEK ENDED JAN. 8

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,220,000	78,700	931,800
Year	4,220,000	78,700	931,800

Shipped during week to separating plants, 5,366,000 lb. zinc ore.

Iron Trade Review

NEW YORK—Jan. 12

The conditions in the iron and steel trades have not materially changed since the close of the year. Demand continues steady and active.

The domestic demand is at present the most insistent. Deliveries are still delayed by railroad congestion and exports are held up by the railroad and the vessel situation. The railroads are gradually clearing themselves, but little relief is in sight in the ocean freight conditions.

Pig iron is still in demand and active. Foundry iron is called for, and basic contracts are being made. A collateral result is the active demand for scrap, both casting scrap and heavy melting steel for the openhearth furnaces.

The United States Steel Corporation has voted to make an increase of 10% in the wages of unskilled laborers, to take effect Feb. 1; also equalization and adjustments in wages of skilled labor which will be equivalent to a parallel increase.

The independent companies are following the lead of the Steel Corporation and are generally granting increases in wages. The strike of the unskilled laborers at Youngstown seems likely to be settled on this basis.

The Cambria-Youngstown-Lackawanna consolidation is said to have made some progress and a capitalization of $200,000,000 has been settled on for the new company. The negotiations are not completed, apparently, but have advanced a stage.

Pig-iron production in Alabama made a record in December when the make of the coke furnaces was 226,254 tons. This makes a total of 2,040,582 tons for the year 1915, being 213,653 tons more than in 1914.. When the output of the charcoal furnaces in 1915 is added it will bring the total up to 2,075,000 tons for the year. In December there were 26 furnaces in blast.

The United States Steel Corporation reports that on Dec. 31 the unfilled orders on its books were 7,806,220 tons, being 616,731 tons more than on Nov. 30. This is the largest figure since January, 1913, and is only 982,780 tons below the maximum figure reached in December, 1906.

PITTSBURGH—Jan. 11

The railroads are still accepting very little steel from Pittsburgh district mills for export, as while a great deal of material has been cleared there is still serious congestion in the East. The New York, New Haven & Hartford and the Boston & Maine are maintaining embargoes on steel routed for New England. As the steel mills maintain their output the consumers of the Central West are receiving more steel than formerly, and the material proves very acceptable.

Men are returning to work at the plants of the Youngstown Sheet & Tube Co. and Republic Iron and Steel Co., at Youngstown, Ohio, which were closed tight last week by strikes, and the plants may be in full operation some time next week. The men are offered 22c. an hour, when the struck for 25c., the former rate having been 19½c. Last Thursday the Steel Corporation announced that a general advance in wages would be made, and the independents have been prompt to follow the lead.

Steel prices are strong all along the line, but the current turnover is light as the mills are already oversold for early deliveries, and as a rule they will not commit themselves for second half. Last week advances occurred in bars, plates, shapes, tubular goods, blue annealed sheets, spikes, rivets and bolts, shafting and cold-rolled strip steel, giving the year a strong opening and furnishing no evidence that there was a holiday or any other kind of a lull in the market.

The Steel Corporation's unfilled obligations increased 615,731 tons during December, equal to one-half its shipments, which were fully up to capacity. The November increase was 1,024,037 tons.

The American Sheet and Tin Plate Co.'s shipments in December were the largest for any month in its history, but the condition was exceptional since its figures take account of export tonnage as cleared at port rather than as shipped from mill, and much material previously shipped from mill was cleared in December, while domestic shipments were swelled by so little material leaving mills for export. The company has booked an order for 100,000 boxes of tinplate for use in making containers for export, the price being approximately $3.75, equal to the full market as recently advanced 15c. per box.

The regular bi-monthly settlement under the Amalgamated Association's sliding wage scale for iron mills was made today, showing that prices realized on bar-iron shipments in November and December were not under 1.30c., as against 1.20c. at the preceding settlement. The puddling rate advances from $5.90 to $6.20 per gross ton while finishing rates in iron mills advance from 3% to 8% in the various scales.

Pig Iron—After its spectacular advance of $3.50 a ton during December, bessemer iron has been quiet, with offerings very limited. There has not been much demand for basic but the next active buying is expected to advance prices sharply as basic is very low relative to bessemer. The foundry-iron market has been quiet of late, partly on account of the strike of molders in this district for an eight-hour day with nine-hour pay. The foundries report progress in getting out tonnage. We quote: Bessemer, $21@21.50; basic, malleable and forge, $18@18.50; foundry, $18.50@19, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The market is strong, with considerable inquiry for second-quarter and later delivery from consumers who had already covered, but find their prospective wants greater. Some of the English producers have withdrawn their $110, Baltimore, quotation, while domestic producers are quoting up to $125 on contract. Prompt is $110@115 per ton.

Steel—The market is quiet, regular consumers being covered on contract, while ordinary finishing mills cannot afford to pay prices asked, $32 to $33 for bessemer billets and sheet bars and $35 for openhearth. Forging billets made to war-steel specifications are above $50. Rods are $40@44, Pittsburgh, with very limited offerings.

FERROALLOYS

Ferrosilicon is in demand and firm. For high-grade, 50% up, the quotation is $83@85 per ton at furnace in the Pittsburgh District. Bessemer ferrosilicon is also firm, prices varying from $28 at furnace for 10% up to $38 for 16% alloy.—**Ferrotungsten** remains high with some variations in price.—**Tungsten** metal is held at $6.50 per lb. for 98% pure.—**Molybdenum** metal is reported sold at $1.50 per lb. Most of the metal now offered is high in sulphur, and good metal is scarce.

IRON ORE

Sales of iron ore have been light since late December, but business is becoming more active, especially in the East. Eastern furnaces seem inclined to make rather large commitments for the year. The Lake situation is not materially changed and preparations are being made for large shipments.

OTHER ORES

Tungsten Ore is rather easier, the sharp demand having brought out some supplies. Current quotations are about $42 per unit for 60% ore and over.

COKE

Coke production in the Connellsville region for the year 1915 is reported by the "Courier" at 17,920,841 short tons. Shipment out of the region were 17,921,216 tons.

Connellsville—The strikes at Youngstown last week caused the banking of five furnaces that had been using Connellsville coke and an oversupply resulted in sales being made Saturday at $2.50, with prospects that the market would go still lower. Today prospects are that the banked furnaces will resume within a few days and the market is stronger than expected, sales of small tonnages being made at $2.50. For delivery over the next few weeks about $3 would be quoted, as winter weather can come at any time and would interfere with both production and shipments. We quote: Furnace, prompt, $2.50; January, $3; first-half, $2.35@2.50; year, $2.25@2.35; foundry, prompt, $3.50@4; contract, $3@3.50, per net ton at ovens.

Anthracite Shipments in December were 5,939,844 long tons, being 237,586 tons more than in December, 1914. For the year ended Dec. 31 the total shipments were 68,342,601 tons in 1914, and 66,122,062 tons in 1915; a decrease of 2,220,539 tons for the year. Making the usual allowance for coal used at mines the total anthracite mined in 1915 was 73,395,500 long tons, or 82,202,950 short tons.

SALT STE. MARIE CANALS

The freight passing through the Sault Ste. Marie Canals in December was 2,180,420 short tons. For the complete season of 1915 the total freight was: East bound, 56,369,242; west bound, 14,921,062; total, 71,290,304 short tons, an increase of 15,920,370 tons over 1914. The number of vessel passages was 21,233, showing an average cargo of 3,358 tons. The mineral freights included in the totals were, in short tons, except salt, which is in barrels:

	1914	1915	Changes
Anthracite	2,240,505	2,030,730 D.	209,775
Bituminous coal	12,246,716	11,326,328 D.	920,388
Iron ore	31,413,765	45,213,604 I.	13,799,839
Pig and m'f'd iron	239,683	211,781 D.	27,902
Copper	91,764	156,436 I.	64,672
Salt, bbl.	777,208	699,337 D.	77,871

In 1915 iron ore was 63.4% and coal 18.7% of the total freight. Of the total, 63,548,993 tons passed through the United States Canal and 7,741,311 tons through the Canadian Canal. The open season was from Apr. 17 to Dec. 20 for the United States Canal; Apr. 13 to Dec. 16 for the Canadian Canal.

Chemicals

NEW YORK—Jan. 12

The general market is recovering from the holiday lull and is showing a fair amount of business for the season.

Arsenic—The market is not especialy active, but is fairly steady. Prices are $4@4.50 per 100 lb. for both spot and futures.

Copper Sulphate—Supplies are rather scarce. The market has been irregular with sharp advances. Early in the week sales were made up to $15, and today quotations are $20 per 100 lb. for carload lots, and $20.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Good arrivals are reported, but most of the material is under contract. Demand continues good. Freight rates from the West Coast are 70@75s. per ton, which is a heavy charge. Prices continue about the same, $3.25 per 100 lb. being asked for both spot and futures.

Pyrites—Receipts at Baltimore for the week included 3,000 tons pyrites from Seville, Spain.

Petroleum

The yearly statement of the "Oil City Derrick" gives the number of new wells completed in 1915 as follows: Pennsylvania grade, 4,085; Lima, 260; Central Ohio, 952; Indiana, 192; Illinois, 756; Kentucky-Tennessee, 104; Kansas, 1,688; Oklahoma-Arkansas, 4,605; Texas Panhandle, 287; Northern Louisiana, 480; Gulf Coast, 819; total, 13,828, having a total daily production of 1,667,432 bbl. There were 1,928 gas wells, and 2,840 dry holes.

An advance estimate puts the production of oil in California in 1915 at 89,768,298 bbl., a decrease of 13,103 bbl. from the preceding year.

Assessments

Company	Delinqe	Sale	Amt.
Albany Lead, Ida	Jan. 20	Feb. 19	$0.005
Alpha, Nev	Jan. 5	Jan. 26	0.03
Alta-Germania, Utah	Dec. 31	Jan. 29	0.005
Andes Silver, Nev.	Jan. 21	Feb. 11	0.02
Argenta, Ida	Dec. 20	Jan. 22	0.001
Atlantic, Ida	Jan. 21	Feb. 21	0.005
Baltimore Cons., Utah	Jan. 11	Feb. 11	0.002
Bay State M. & M., Utah	Jan. 10	Jan. 25	0.001
Bellerophon, Utah	Jan. 8	Jan. 29	0.005
Big Elk, Ida	Jan. 25	Feb. 15	0.001
Cedar Creek, Ida	Dec. 30	Jan. 29	0.01
Challenge Cons., Nev	Jan. 11	Feb. 1	0.05
Clear Grit, Ida, (post.)	.....	Jan. 24	0.0015
Consolidated Mines, Calif	Dec. 16	.....	.....
Demijohn Cons., Nev	Jan. 7	Jan. 27	0.005
Empire M. & D. Ida	Jan. 15	Feb. 15	0.005
Four Timbers, Wash	Dec. 24	Jan. 20	0.001
Gold Mt. Champion, Utah	Jan. 21	Feb. 8	0.0025
Goldstrike Bonanza, Utah	Jan. 3	Jan. 20	0.0025
Hale Norcross, Nev	Jan. 25	Feb. 15	0.03
Hypotheek, Ida	Dec. 20	Jan. 20	0.005
Idaho-Nevada, Ida	Jan. 7	Feb. 1	0.002
Imlay, Nev	Jan. 7	Feb. 8	0.01
Independence, Utah	Jan. 20	Feb. 14	0.001
Lehi-Tintic, Utah	Jan. 15	Feb. 5	0.002
Lucky Calumet Cop., Ida	Dec. 27	Jan. 28	0.005
Lucky Swede, Ida	Jan. 11	Feb. 11	0.002
Maj. Evans Cons	Jan. 3	Jan. 20	0.002
Massasoit, Utah	Jan. 13	Feb. 23	0.015
Mexican Nev	Jan. 25	Feb. 16	0.10
Monte Cristo, Utah	Jan. 5	Jan. 27	0.00½
Nabob, Ida	Jan. 17	Feb. 14	0.005
Nevada-Anaconda, Utah	Dec. 29	Jan. 29	0.002
Old Veteran, Ida	Jan. 6	Jan. 29	0.002
Ophir, Nev	Jan. 19	Feb. 10	0.05
Rexall, Utah	Feb. 2	Feb. 21	0.01
Santaquin, Utah	Dec. 28	Jan. 14	0.005
Sierra Nevada, Nev	Jan. 19	Feb. 9	0.10
Sixes Mining, Utah	Jan. 3	Jan. 19	0.10
Superior & Boston, Mich	Feb. 7	.....	1.00
Tar Baby, Utah	Dec. 31	Feb. 28	0.005
Utah-Oregon, Utah	Jan. 5	Feb. 10	0.0005
Victoria, Utah	Dec. 28	Jan. 29	0.01
Wasatch Marble, Utah	Dec. 15	Feb. 2	0.06
Western M. & M., Utah	Jan. 3	Jan. 25	0.0015
Western Star, Ida	Jan. 10	Jan. 31	0.001
White Cloud, Utah	Dec. 31	Jan. 24	0.01

Stock Quotations

COLO. SPRINGS Jan. 11		SALT LAKE Jan. 11	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03½	Beck Tunnel	.07½
Cripple Cr'k Con	.008	Black Jack	.07½
C. K. & N	‡.02	Colorado Mining	.09½
Doctor Jack Pot	.09½	Crown Point	.02
Elkton Con	.36	Daly-Judge	7.80
El Paso	.96	Emma Cop	.20½
Findlay	.03½	Gold Chain	.55
Gold Dollar	.02	Grand Central	.54
Gold Sovereign	.06	Iron Blossom	1.20
Golden Cycle	1.99½	Lower Mammoth	.05
Isabella	.22½	May Day	.20
Jack Pot	.06½	Opohongo	.02
Jerry Johnson	.05	Prince Con	.79
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.40	Silver King Coal'n	3.42½
Pharmacist	.005	Silver King Con	2.12½
Portland	1.85	Sioux Con	.03½
Raven B. H	.02	Uncle Sam	.07
Vindicator	2.25	Yankee	.29

SAN FRANCISCO Jan. 11			
Alta	.09	Belmont	4.50
Andes	.08	Jim Butler	1.07½
Best & Belcher	.05	Lone Star	.03
Caledonia	.34	MacNamara	.03
Challenge Con	.06	Midway	.15
Chollar	.03	Mont.-Tonopah	.30
Confidence	.20	North Star	.15
Con. Virginia	.18	Rescue Eula	.07
Gould & Curry	.02	West End Con	.72
Hale & Norcross	.02	Atlanta	.21
Jacket-Cr. Pt	.13	Blue Bell	.02
Julia	.01	Booth	.40
Mexican	.22	C.O.D. Con	.03
Occidental	.75	Comb. Frac	.07
Ophir	.27	D'field Daisy	.03
Overman	.05	Jumbo Extension	1.27½
Savage	.04	Pitts.-Silver Peak	.06
Seg Belcher	.04	Round Mountain	.41
Sierra Nevada	.32	Sandstorm Kendall	.07
Union Con	.60	Silver Pick	.05
Utah Con	.01	Central Eureka	.08

TORONTO Jan. 11			
Bailey	.04½	Dome Exten	.35½
Chambers Ferland	.30	Dome Lake	.28
Coniagas	4.75	Foley O'Brien	.75
La Rose	.62	Hollinger	29.25
Peterson Lake	.34½	Imperial	.05
Right of Way	.06½	Jupiter	.22½
Seneca Superior	.65	McIntyre	1.00
T. & Hudson Bay	25.00	Porcu. Crown	.84½
Temiskaming	.70	Preston E. D.	.06½
Trethewey	.18	Vipond	.69½
Wettlaufer-Lor	.08½	West Dome	.06½

LONDON Dec. 27			
Alaska Tre'dwell	£7 7s 6d	Mexico Mines	£4 0s 0d
Burma Corp	1 13 12½	Nechi, pfd	0 11 3
Cam & Motor	0 14 3	Oroville	0 13 6
Camp Bird	0 7 0	Santa Gert'dis	0 9 6
El Oro	0 9 0	Tomboy	1 3 0
Esperanza	0 10 9	Tough Oakes	0 12 6

N. Y. EXCH. Jan. 11		BOSTON EXCH Jan. 11	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Gold M	25½	Adventure	2
Alaska Juneau	9⅞	Ahmeek	394
Am.Sm.&Ref.,com	106⅛	Algomah	1½
Am. Sm. & Ref., pf.	112	Allouez	65
Am. Sm. Sec., pf. A	93½	Ariz. Com., ctfs	9½
Am. Sm. Sec., pf. B.	86½	Bonanza	.35
Am. Zinc	67	Butte Alex. Scott	8
Anaconda	88½	Butte-Ballaklava	3
Batopilas Min	3	Calumet & Ariz	69⅛
Bethlehem Steel	415	Calumet & Hecla	550
Bethlehem Steel, pf.	143½	Centennial	17
Butte & Superior	74½	Copper Range	63
Chile Cop	24	Daly West	3
Chino	53½	East Butte	15½
Colo. Fuel & Iron	46½	Franklin	10
Crucible Steel	54½	Granby	84½
Dome Mines	28	Hancock	18
Federal M. & S	30	Hedley	‡28
Federal M. & S., pf.	52⅛	Helvetia	.50
Great Nor., ore., ctf.	47½	Indiana	5½
Greene Cananea	48	Island Cr'k, com	47½
Guggen. Exp	23	Island Cr'k, pfd	89½
Homestake	125½	Isle Royale	29½
Inspiration Con	46⅛	Keweenaw	3
International Nickel	202½	Lake	17½
Lackawanna Steel	81½	La Salle	5½
Miami Copper	37⅛	Mason Valley	3½
Nat'l Lead, com	67½	Mass	12½
National Lead, pf	113	Mayflower	3½
Nev. Consol	15½	Michigan	1½
Ontario Min	9⅛	Mohawk	90½
Quicksilver	4	New Arcadian	9
Quicksilver, pf	5	New Idria	11
Ray Con	24½	North Butte	29½
Republic I&S, com	50½	North Lake	1½
Republic I&S, pf	108½	Ojibway	1½
Sloss-Sheffield	58	Old Colony	3½
Sloss-Sheffield, pf	100	Old Dominion	55
Tennessee Copper	58½	Osceola	86
Utah Copper	79	Quincy	88
U. S. Steel, com	85½	St. Mary's M. L	62
U. S. Steel, pf	117⅛	Santa Fe	3½
Va. Iron C. & C	60	Shannon	8⅛
		Shattuck-Ariz	32½
		So. Lake	7½
		Superior	26
		Superior & Bost	1½
		Tamarack	51½
		Trinity	10½
		Tuolumne	.30
		U. S. Smelting	58
		U. S. Smelt'g, pf	50
		Utah Apex	3½
		Utah Con	13
		Victoria	3½
		Winona	4½
		Wolverine	60
		Wyandot	2

N. Y. CURB Jan. 11		BOSTON CURB Jan. 11	
Alta Con	.27	Bingham Mines	8
Beaver Con	.42	Boston Ely	.47
Big Four	.04	Butte & Lon'n Dev.	.40
Buffalo Mines	1	Calaveras	3½
Butte & N. Y	2⅛	Calumet-Corbin	.06
Butte C. & Z	8½	Chief Con	1½
Can. Cop. Corpn	2	Cortez	.95
Cashboy	.04	Crown Reserve	.65
Cerro de Pasco	37½	Davis-Daly	1⅛
Con. Ariz. Sm	1⅛	Eagle & Blue Bell	1½
Con. Coppermines	2	First Nat. Cop	7⅛
Con. Nev.-Utah	⅛	Houghton Copper	3
Dia. Black B	.04½	Iron Cap Cop., pf	7½
Florence	.50	Mexican Metals	.38
Goldfield Con	1 1/16	Nat. Zinc & Lead	2½
Goldfield Merger	.18	Nevada-Douglas	.81
Hecla Min	‡3½	New Baltic	2½
Howe Sound	6½	New Cornelia	12
Kennecott Cop	54½	Ohio Copper	.25
Kerr Lake	4½	Oneco	1
Magma	15½	Raven Copper	.12
Majestic	1½	Rex Cons	.32
McKinley-Dar-Sa	.45	Smokey Dev	.30
Mines of Am	3	Tonopah Victor	‡.35
Mother Lode	.25	United Verde Ext	5½
Nevada Hills	.19	Utah Metal	9½
New Utah Bingham	5½		
Nipissing Mines	7⅛	‡Last Quotations.	
Oro	.05½		
Ray Hercules	3		
Rochester Mines	.65		
St. Joseph Lead	15½		
South Utah	‡.35		
Stand'd Oil of N.J.	512		
Standard S. L	1⅞		
Stewart	⅛		
Success	.72		
Tonopah	6⅞		
Tonopah Ex	4		
Tonopah Merger	.60		
Tribullion	1⅛		
White Knob, pf	2		
Yukon Gold	2½		

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	49.385	28.083	23.199	23.925
November	58.995	49.082	51.714	27.263	22.703	25.094
December	57.760	49.375	54.971	26.720	22.900	26.373
Year	59.791	54.811	49.684	27.576	25.314	23.675

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*	17.686	‡	72.601	‡	88.000
November	11.739	18.627	53.227	77.744	*	93.273
December	12.801	20.133	56.841	80.773	*	100.43
Year	.....	17.275	.....	72.532	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284	33.080	‡	151.554
November	33.304	39.224	139.391	167.670
December	33.601	38.779	147.102	167.000
Av. year	34.301	38.500	.....	163.960

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528	4.600	3.384	4.499	‡	23.994
November	3.683	5.155	3.585	5.078	18.500	26.278
December	3.800	5.355	3.662	5.266	19.097	28.790
Year	3.862	4.628	3.737	4.567	.....	22.916

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909	12.800	4.750	12.596	‡	66.536
November	5.112	15.962	4.962	15.792	25.016	88.409
December	5.592	15.391	5.430	15.221	27.369	89.400
Year	5.213	13.230	5.061	13.054	.....	67.553

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	12.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.86	13.90	15.95	14.03	15.70
October	14.84	16.95	13.75	15.96	13.97	15.80
November	14.59	18.26	13.43	17.30	13.83	17.20
December	14.70	19.95	13.45	18.95	13.83	18.95
Year	$14.88	$14.89	$13.78	$13.76	$14.01	$13.89